THE AEROPLANE

Incorporating
Aeronautical Engineering

Founder and First Editor
(1911-1939), C. G. GREY

Edited by - - THURSTAN JAMES

Proprietors:
TEMPLE PRESS LIMITED

Chairman and
Managing Director:
ROLAND E. DANGERFIELD

Head Office:
BOWLING GREEN LANE,
LONDON, E.C.1.
Telephone: Terminus 3636
Telegrams:
"Pressimus London Telex."
Telex 23839

Vol. XCV. No. 2452 AUGUST 29, 1958

Annual Subscription Rate: U.K. £4.15.0.
Overseas £5. Canada and U.S.A. $15.00

EVE OF FARNBOROUGH MUSINGS

BRITISH aeroplanes are in the news. The de Havilland Comet has recently linked New York and London in six and a half hours. A Bristol Britannia has flown from Tokyo to Vancouver in thirteen and a half hours. The Comet stands a very good chance of being the first jet airliner to operate a regular transatlantic service. The Britannia is earning laurels in service not only over the Atlantic but universally. A licence to build the Fairey Rotodyne, the World's first VTOL airliner, has been acquired by a famous American helicopter constructor, even before it has gone into service here. Against this background of achievement more visitors than ever before are expected to visit the 19th annual S.B.A.C. Show and Flying Display on the most historic flying field in England. And in this issue we have set forth the products of the British Aircraft Industry with particular reference to what will be on show.

We wish that British flying-boats were in the news. It is a long time now since flying-boats were seen at the S.B.A.C. display. A proposal was recently made that the last flying-boat in service with the R.A.F. should be brought home and make a farewell flight at Farnborough. The last big flying-boat to fly at the Show has been in mothballs and without engines for a long time, as have its sister ships. Yet almost every day further news comes in about the limitations imposed on the ability of Transport Command to move military personnel and equipment because of restrictions on the use of airspace or staging posts by countries hostile to British policy. This situation is likely to worsen as time goes on.

In the past the flying-boat has been vulnerable to flotsam and jetsam on the water lanes down which it must fly for take-off and alighting. With the coming of VTOL capability the problems of high take-off speeds and even problems of the "hump" (the speed at which resistance on the water is a maximum) may well disappear. The flying-boat would then have all the advantages of being able to cruise over and alight on waterways with a very substantial reduction in the risk of holing the hull by striking obstructions on the water at high speed. And the seaways of the World are still open to all who can use them. Flying-boats can land their loads on beaches.

A full range of British aircraft cannot be seen at the Show as the rules forbid the appearance of an aircraft with anything other than a British-built engine. The converse is also true. It certainly would be awkward if all aircraft with British engines were to be shown at Farnborough; the Display would take on a distinctly international flavour. Indeed, if there were such a reversal of policy as to allow such a thing to happen, it would be more than ever necessary to consider holding the British Show alternatively with the International Show held in Paris every second year. But as everybody will tell you, this is not even a remote possibility.

Much less conspicuous but of considerable significance will be the exhibits of the electronics specialists, who today have two organizations of their own: the Electronic Engineering Association; and the Radio and Electronic Component Manufacturers Federation. Some companies are members of both bodies.

Nobody has so far produced a generally accepted definition of electronics. If you look in the Oxford Dictionary you will learn that electronics is that branch of physics which deals with electrons and the other elementary particles that constitute matter. However precise this definition may be, it is certainly far more limited than the popular use of the word assumes. We have yet to hear of a really satisfactory definition. Moreover we have found that even members of the Electronic Engineering Association do not find the task of supplying a definition an easy one. The Royal Air Force has produced that most useful phrase "little black boxes." And the little black boxes, now so often in some other colour, generally do contain the products of the manufacturers whom we have in mind.

We have now reached the stage when it can be said that aviation is dependent on electronics for its day-to-day operation and for its safety. Its progress will be linked with that of the little black boxes. Navigational aids and automatic pilotage, communications, flight planning and operational planning all make use of electronic techniques.

As for air defence it is universally known that radar and its associated military applications have made fantastic progress since the days when the first radio location gear gave this country superiority over its airborne invaders. This progress has been emphasized by the coming of the guided missile and of the space vehicles which is presumably the name that one should use for rockets to the moon and suchlike spacecraft.

One of the fields in which much progress has been made is in that of building simulators for the training of aircrew. Again this is an application of electronics.

The stands of the electronic firms are nevertheless only a proportion of the four hundred or more at Farnborough. In this issue a guide will be found to them all.

MATTERS OF MOMENT

All Set for Farnborough

NEXT WEEK, Farnborough will once again become the focus of aviation interest throughout the World, as the Society of British Aircraft Constructors stages its 19th annual Flying Display and Exhibition. Preliminary information from the S.B.A.C. and the manufacturers suggests that the event this year will be no less interesting than usual. With the record of still-mounting exports to encourage it, the industry is in no mood to display in public the effects of the transition period through which it is passing; the static show is bigger than ever and there will be no fewer aircraft in the flying display than last year.

Elsewhere in this specially enlarged issue we have reviewed the current aircraft, engine and missile products of the industry, and have also included a preview of the ancillary industry exhibits at Farnborough. As usual, there are a few uncertainties about the actual aircraft to be on display, but the best information available as we go to press shows that the following types should be seen in the flying display:—

Auster Alpha, Aiglet Trainer; **Avro** Vulcan B.2; **Blackburn** NA.39; **Bristol** 192; **de Havilland** Comet 4, Comet 3B (short span), Sea Vixen, Chipmunk 23, Beaver; **English Electric** Lightning, Canberra T.11; **Fairey** Rotodyne, F.D.2, Ultra Light, Gannet AEW.3; **Folland** Gnat; **Gloster** Javelin FAW.8; **Handley Page** Victor, Dart Herald; **Hawker** Hunter F.6, T.7, T.8; **Hunting** Jet Provost, President; **Saro** P.531, Skeeter; **Scottish Aviation** Twin Pioneer; **Vickers** Viscount 812; **Westland** Westminster, Wessex, Widgeon, Whirlwind; **Napier** Scorpion-Canberra; **Rolls-Royce** Tyne-Ambassador, Conway-Vulcan.

In the static park, second examples of some of these types will be on permanent display with, in addition, the following aircraft:—

Bristol Britannia 312, Sycamore; **de Havilland** Dove, Heron, Vampire Trainer; **Short Brothers and Harland** SC.1, Canberra U.10.

The outdoor missile park will be enlarged this year and will include examples of the Armstrong Whitworth Seaslug (propulsion test vehicle), Bristol Bloodhound, de Havilland Firestreak, Fairey Fireflash and Jindivik, English Electric Thunderbird (operational type) and Short-Elliott GPV general-purpose test vehicle.

Nearly 40 aero-engines will be shown in the static exhibition, including several not previously seen at an S.B.A.C. display. They comprise:—

Alvis Leonides 530, Leonides Major; **Armstrong Siddeley** P.181, P.182, Double Mamba, Sapphire, Viper and PR23 rocket engine; **Blackburn** Bombardier, A.129, Turmo and Palas; **Bristol** Orpheus, Olympus 201, Proteus 765 and Thor; **de Havilland** Gyron, Gyron Junior, Gnome, Spectre and Gipsy Major 215; **Napier** Eland, Gazelle, Double Scorpion, Triple Scorpion, N.R.E.11, N.R.E.17 and N.R.E.19; **Orenda** Iroquois; **Rolls-Royce** Conway, Tyne, Dart, Avon R.A.24, Avon R.A.29, R.B.108.

The pattern of the display is largely as before, with the Monday restricted for a Press and technicians pre-view; the formal guest days on Tuesday, Wednesday and Thursday; and Friday, Saturday and Sunday reserved for the public. Flying begins at 14.30 hr. on the trade days and at 15.00 hr. on the public days, the full programme being repeated each day. In addition to the manufacturers' exhibits, the R.A.F. and R.N. will provide extensive support each day. The R.A.F. programme is expected to include an impressives formation of Hunters from No. 111 Squadron; a Valiant flight refuelling demonstration; aerobatics by Jet Provosts and fly pasts by V-bombers, Canberras, Javelins and Hunters. The R.N. will provide aerobatic teams of Sea Hawks and Scimitars.

Rotodyne Licence Agreement

ON August 19 the Fairey Aviation Company announced that they had that day agreed with the Kaman Aircraft Corporation of Bloomfield, Connecticut, the terms of a licence for the manufacture and sale of the Fairey Rotodyne vertical take-off airliner in the United States. The company stated the step had been taken in order fully to exploit the potentialities of the Fairey Rotodyne in the military and civil markets of the U.S.

The statement made it clear that the agreement would be subject to the approval of the Governments of Great Britain and the U.S.A.

A brief notice about the negotiations appeared in THE AEROPLANE last week. The successful conclusion of the agreement must greatly satisfy the Fairey Company. Everybody must hope that the agreement receives the approval of the Governments concerned.

We understand that the Kaman order book is already impressively filled. However, in view is a further order for some 200 helicopters for the American Army and nowhere in the World is a machine which can offer the performance now being demonstrated by the Fairey Rotodyne. The fact that if ordered for the American Services the Rotodyne could and would be built in the United States puts the Rotodyne on an equal footing for suitability with American designs that have yet to be developed.

There is perennial truth in the wry saying that prophets have honour all over the Earth except in the village where they were born. The same is unfortunately true of new developments. How many good ideas have been thought out in England but have failed to make headway until developed in the United States.

It will be fine to see the dollars rolling in for Rotodyne royalties. It would have been finer still, and much more satisfactory to everyone in the Fairey factories, if the Ministry of

LATEST GANNET.—To be seen at Farnborough is the Fairey Gannet AEW.3 (Armstrong Siddeley Double Mamba) which is being produced for the Royal Navy to Ministry of Supply order. It first flew on August 20, piloted by Mr. Peter Twiss, who took it from Fairey's assembly works at Northolt to White Waltham. It was airborne for 1 hr. 16 min. More information is on page 306.

ATLANTIC CONTENDER.—The first production D.H. Comet 4, G-APDA, which, as we reported last week, flew from New York to London in record time. This type is to go into service on B.O.A.C.'s Atlantic route towards the end of this year.

Supply had been able to develop the Rotodyne here so that complete British Rotodynes could have been exported for dollars.

It will be a wry comment on the position in this country if Kaman-built Rotodynes are flying with the American Armed Services before B.E.A. or our own Army have one in operation.

R.A.A.F. Procurement Policy

THE Royal Australian Air Force is at something of a cross-roads so far as re-equipment is concerned. A decision has soon to be taken whether or not to order individual replacements for the Avon-Sabre fighters and Canberra light bombers, or to obtain a single type to fulfil both requirements. At the moment, the latter course is considered more attractive, except for the difficulty of obtaining sufficient range from available designs.

Typical operating radius considered necessary for future R.A.A.F. operations is, for example, to cover Indonesia from Darwin, which eliminates all current British tactical designs, and severely restricts the choice among other types. The range problem was one of the reasons for the non-selection by Australia of the Lockheed F-104 and is the only detracting feature, from the R.A.A.F. point of view, of the versatile Republic F-105 fighter-bomber.

Considerable interest, following the visit to Australia of a U.S. sales team, has been shown in the Mach 2+ Northrop N-156F "Counterair" fighter-bomber project. From the American point of view, the Australian order, with its considerable local production potential, is a particularly desirable plum, additionally because of the desirability of equipment standardization in SEATO.

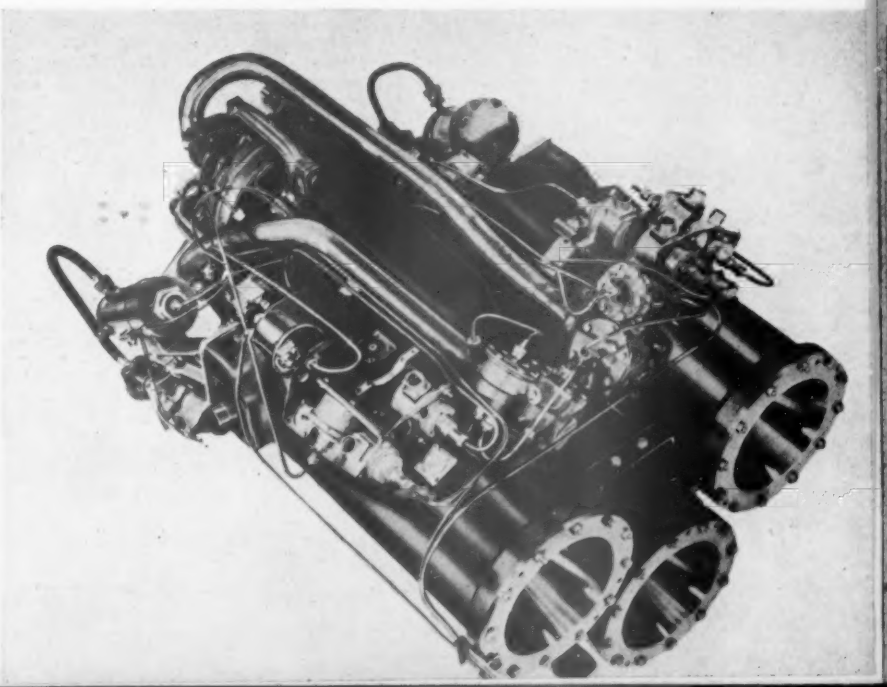
As the entire Australian defence budget does not exceed £A200 million per year, economic considerations in aircraft procurement have a very high degree of priority. For this reason, the R.A.A.F. will probably regretfully pass over the projected Maritime Reconnaissance version of the Lockheed Electra, and opt for some more Neptunes, which are continuing in production until 1960.

In the transport field, the R.A.A.F. is looking for something with a non-stop range capability of Darwin-Singapore or Darwin-Butterworth, to replace its C-47s, and while a few more Lockheed C-130s may be procured for additional freight capacity, aircraft in the class of the Handley Page Herald or Fokker Friendship are required for troop and personnel transport. At the moment, the range requirements appear to favour the Herald.

Australia is fairly firmly committed to the continuation of manned aircraft; its missile development programme is therefore likely to be slow.

CONTENTS

MATTERS OF MOMENT 280
NEWS ITEMS 283
BLACKBURN B.107 MILITARY TRANSPORT 286
DISPLAY ITEMS IN BRATISLAVA 288
AIR TRANSPORT 289
THE FIGHTING SERVICES 291
SPECIAL SUPPLEMENT: THE BRITISH AIRCRAFT INDUSTRY
Aviation Exports Month by Month 292
Research and Development Prospects, by J. R. Cownie 293
British Aircraft, Aero-engines and Guided Weapons (Colour Section) 297
S.B.A.C. Static Exhibition 329
Trade Directory Section 341
PRIVATE FLYING AND GLIDING 349
CORRESPONDENCE 351
NOTES AND EVENTS 352



THREE-BORE THRUST. — Probably destined for the English Electric Lightning, the Triple Scorpion N.Sc.T.1 is the latest bi-propellent rocket by Napiers. It uses hydrogen peroxide oxidant and kerosene fuel.

H.P.113 Laminar-Flow Research Transport

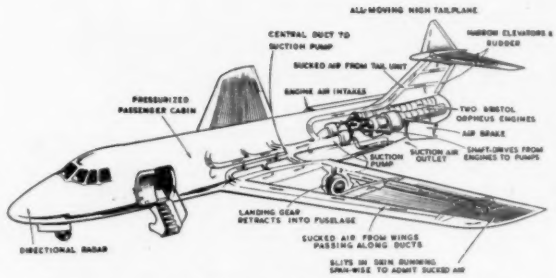
LATEST in a series of laminar-flow design studies by Handley Page is the H.P.113, a 12-seat jet transport which can act both as a research vehicle for demonstrating the practical advantages of the laminar-flow technique for long-range flight and as a long-range executive aircraft.

It is reported that construction of an H.P.113 prototype will begin this year and that the first flight will be in about 2½ years' time. Money for the aircraft's development is said to have been made available from an unknown source; it will amount to about £1 million by the time of the first flight. The project does not have financial backing from the Ministry of Supply; it is known, however, that the U.S. is interested in the laminar-flow technique.

Powered by two rear-mounted Bristol Orpheus turbojets, the H.P.113 has a wing swept at 35° and cruises at 528 m.p.h. over long ranges. It could carry 12 passengers non-stop between London and New York in 6½ hr., or 10 passengers non-stop over the 4,100 miles between Aden and Singapore in 8¼ hr. Between Lyneham, Wilts, and Woomera, Australia, it could carry 11 passengers in less than 21 flying hours, with two stops en route.

Use of the laminar-flow technique reduces the H.P.113's drag; smooth non-turbulent airflow is maintained in the boundary layer. This is done by sucking a small quantity of boundary-layer air through the wing and tail surfaces. With a conventional aircraft the boundary-layer airflow is turbulent and thus surface drag is considerably greater.

Although power is needed to suck air in through the aerofoil surfaces, the use of power in this way is much more efficient than if it were employed as thrust to balance the higher drag of unsucked wing and tail surfaces. A comparison of the aircraft in its conventional and laminar-flow forms shows the advantages of eliminating turbulent airflow in the boundary layer. The maximum range is increased from 3,870 to 6,300 miles, and the range with the maximum payload of 2,520 lb. and full allowances is increased by over 60% from 2,240 to 3,640 miles.


ALL-MOVING HIGH TAILPLANE
CENTRAL DUCT TO SUCTION PUMP
RUDDER ELEVATORS & RUDDER
SUCKED AIR FROM TAIL UNIT
ENGINE AIR INTAKES
PRESSURIZED PASSENGER CABIN
TWO BRISTOL ORPHEUS ENGINES
AIR BRAKE
SUCTION PUMP
SUCTION AIR OUTLET
SHAFT-DRIVES FROM ENGINES TO PUMPS
LANDING GEAR RETRACTS INTO FUSELAGE
SUCKED AIR FROM WINGS PASSING ALONG DUCTS
DIRECTIONAL RADAR
SLITS IN SKIN RUNNING SPAN-WISE TO ADMIT SUCKED AIR

On the H.P.113 air is sucked through thin spanwise slits, machined in the wing and tail surfaces, by two four-stage axial compressors driven by the engines. At the wing leading edges and access doors it is sucked through porous steel skinning. To give the maximum area for suction the tailplane is an all-moving surface and small-chord ailerons and rudder are used; in low-speed flight an automatic blowing system increases their effectiveness.

Technical Details

DIMENSIONS.— Wing span, 71 ft. 3 in.; length, 71 ft. 6 in; height, 17 ft.; max. fuselage diameter, 7 ft. 3 in.; wing area, 775 sq. ft.

WEIGHTS.—All-up weight, 36,500 lb.; basic operational weight, 20,450 lb.; max. payload, 2,520 lb.; fuel capacity, 2,290 gal.

PERFORMANCE.—Take-off distance to 50 ft. at 36,500 lb., sea-level, I.S.A. +15° C., 3,260 ft.; time to 30,000 ft., 14 min.; max. stage length with 1,000 lb. payload, 4,330 miles; landing distance from 50 ft. at 25,000 lb., 2,480 ft.

Blue Streak Round-Up

INFORMATION about Britain's first LRBM, the de Havilland Blue Streak, has come from various sources in past months. To be launched from underground sites, the Blue Streak is being developed at top priority; it will have a thermo-nuclear warhead and a range of 2,000-2,500 miles.

The prime contractor and co-ordinating authority for design, development and firing trials is de Havilland Propellers, Ltd. Main sub-contractors are de Havilland Aircraft, Rolls-Royce and Sperry, responsible respectively for the airframe, propulsion and guidance.

The rocket motor for this missile is reported to be based on one developed by the Rocketdyne division of North American Aircraft for U.S. ballistic missiles. Rolls-Royce rocket tests are to be at Spadeadam Waste, Cumberland. A new Armstrong Siddeley rocket motor, the 500-lb. thrust PR23, may well be used as a vernier rocket for controlling the Blue Streak's attitude and making fine adjustments to its speed.

In parallel with work on the Blue Streak, Saunders-Roe, Ltd., is developing the Black Knight, a re-entry research vehicle. Tests with this will presumably decide the type of re-entry nose cone adopted for the Blue Streak. It may well be that an advanced ablative nose cone will be used in place of the blunt heat-sink ones initially adopted for U.S. missiles.

A cylindrical portion of the Blue Streak airframe, about 60 ft. long and 10 ft. in diameter, was placed in a vertical test rig at Hatfield in April. Full-range firings of the Blue Streak will take place at Woomera in 1960 and the range is being extended over the Indian Ocean for this purpose. The target area is 30 miles in diameter. Initial firings, presumably, may be made next year. Latest news of the Blue Streak and Black Knight is that they may be used to launch Earth satellites; this proposal is under discussion with the Royal Society.

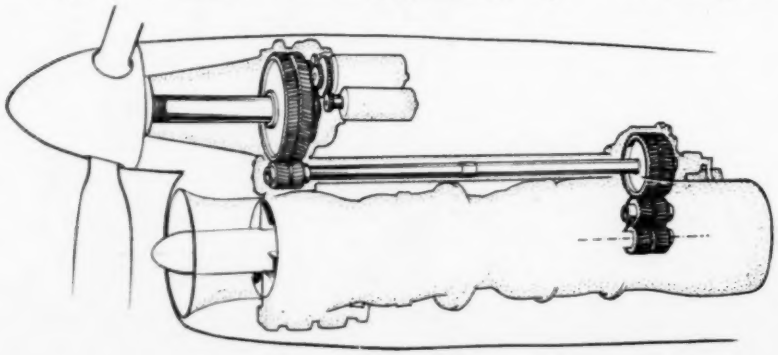
The Turboprop Gnome

SINGLE and coupled de Havilland Gnome shaft turbines will be available as turboprop engines. The 1,000-s.h.p. Gnome D.Ge.1 is under development by The de Havilland Engine Co., Ltd., from the General Electric T58 (see our issue for August 15, which contains a full description with cutaway drawing).

The turboprop versions of the Gnome will be available with reduction gearing and drive shafts to suit particular installations. It should, therefore, be possible to arrange the propeller shafts to be above, below or to one side of the powerplant, according to the needs of the individual aeroplane configuration. The simplest engine layout will have a drive forward from the normal reduction gearing at the rear of the engine, over the top to a further reduction gear above the air intake.

In coupled form, two Gnomes will power a single output shaft, it being possible to shut down one engine for maximum economy in cruising flight. The two free power-turbines will drive into a gearbox which couples the drives through a free-wheel clutch. A single offset drive shaft running parallel with the engine axes will transmit power to a forward housing and propeller shaft assembly.

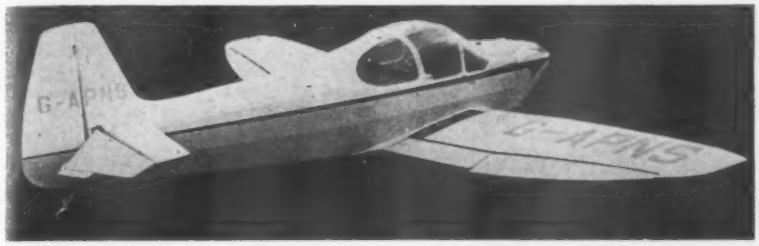
As a single turboprop engine the Gnome will have a 5-min. take-off rating of 1,000 s.h.p. with a specific fuel consumption of 0.67 lb./s.h.p./hr. and a dry weight of 525 lb.



TURBOPROP TRANSMISSION.—This sketch indicates the transmission layout of the 1,000-s.h.p. single turboprop de Havilland Gnome engine. Coupled Gnomes would drive a single power-output shaft through a gearbox and free-wheel clutch.

Drawing copyright "The Aeroplane"

News of Aircraft, Engines and Missiles



Photograph copyright "The Aeroplane"

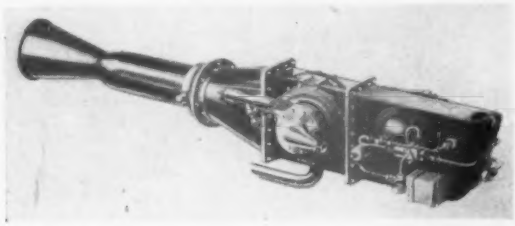
NEW LIGHTWEIGHT.—First picture of the Garland-Bianchi Linnet two-seater, which will probably have flown by the time this issue appears. Flight testing is to be done by Sqn. Ldr. Neville Duke at Fair Oaks. The Linnet, built at Bayne Hill Works, Maidenhead, is a British version of the French Piel Emeraude. Ten are being laid down initially, to sell at about £2,000 each.

ROLLS-ROYCE TEST PLANT.—A new Rolls-Royce test plant at Derby will be opened by the Prime Minister on September 26. It has cost nearly £4 million. With it engines can be tested in conditions representing flight at heights up to 70,000 ft. and speeds up to Mach 2.5.

CENTURY EJECTION.—A study of standardization on downward ejection seats conducted by Lockheed for the U.S.A.F. has been cancelled. This follows several accidents to the F-104, involving unsuccessful ejections with the downward seat, which is not recommended for use below 500 ft. A prolonged study on upward ejection seats for the Century-series fighters has been made by Convair in conjunction with the supersonic sled at Edwards AFB. The U.S. Navy has avoided all these problems by adopting the British Martin-Baker ejection seat, which is suitable for use at all altitudes, and all speeds from 80 knots and above.

INDONESIAN MiGs.—According to a recent official statement, eight MiG fighters were recently supplied by Russia to the Indonesian Air Force as part of an overall expansion programme.

ROCKET TRIMMER.—This PR23 new liquid-propellent rocket by Armstrong Siddeley has a thrust of 500 lb. and weighs 30 lb. It can be used for trimming altitude and speed of an LRBM.



AIMING HIGH.—The North American X-15, which is expected to reach a height of 100 miles, is scheduled to fly in February next, according to the NACA. The aircraft should be completed by December 1.

GERMAN TWO-SEATER.—The prototype Pützer Elster, D-EJOB (52-h.p. Porsche engine), seen here at Nuremburg. It will cruise at about 80 m.p.h. and sell at about £1,800.

NEW Tu-104 VARIANT. — Details have been given in the Russian Press of a Tu-104 variant known as the Tu-104B. Dimensionally similar to the Tu-104, the new version seats 100 passengers in five-abreast seats throughout. Other versions are the Tu-104, seating 50, and the Tu-104A with 70 seats.

NAVAL VTOL.—A jet reaction control system is under development by the Ryan Aeronautical Co. for a U.S. Navy tactical VTOL aircraft. The engine to be used is a General Electric J79 with afterburner.

SPACE DIVISION.—A new Space Flight Division has been established by the Martin Co. This will direct the group of companies—Bell Aircraft, Bendix Aviation, Minneapolis-Honeywell Regulator, Goodyear Aircraft, American Machine and Foundry—working with Martin on the Dyna-Soar boost-glide project for the U.S.A.F. This team is in competition with another led by Boeing.

VALKYRIE PROGRESS.—According to *Aviation Daily*, work on the North American B-70 Valkyrie Mach-3 bomber will be stepped up soon. Speed of progress depends on availability of heat-resisting materials and development of the General Electric J93 engine. The J93 may use its afterburner as a ramjet, operating on hydrocarbon rather than chemical "zip" fuels.

T-38 ROLL-OUT.—The first Northrop T-38 supersonic trainer was rolled out at Hawthorne, Calif., on August 15 without its two General Electric J85 turbojets. Fairchild J83s. may be fitted later.

COMET 3B FLIES.—The modified Comet 3, with span reduced by seven feet to make it a Comet "3B"—or prototype for the 4B—flew again at Hatfield on August 21 with Mr. Peter Buggé and Mr. Peter Wilson as pilot and co-pilot respectively. The 3B, which was airborne for 1 hr. 40 min., will be seen at the S.B.A.C. Display next week.

GULFSTREAM FLIES. — The Grumman 159 Gulfstream twin-Dart executive made its first flight on August 14. The company reports 27 provisional orders to date. Details of the Gulfstream were in THE AEROPLANE, July 4 last.

MIGHTY ROCKET.—The Rocketdyne division of North American Aviation has been awarded a U.S.A.F. contract for development of a rocket engine with a million-pound thrust. Rocketdyne produces liquid-propellent engines for the Atlas ICBM and the Thor and Jupiter IRBMs.

ARGUS NEWS.—Canadair, Ltd., states that by the middle of August the first 12 CL-28 Argus maritime reconnaissance aircraft produced for the R.C.A.F. had flown a total of more than 1,700 hr. —almost 350,000 miles. Five aircraft were then in squadron service, flying from Greenwood, Nova Scotia; the others were engaged on development work. The first Argus Mk. 2, the 14th aircraft built, has the latest detection and tactical equipment. The main external difference lies in the smaller radome.

SOVIET SUPER AEROS.—A sales agreement has been concluded between Aeroflot and Omnipol, the Czech aircraft export organization, for the supply of 130 Super Aero 45s to Russia. The Super Aeros will be powered by Walter Minor 4-III engines, have Czech 10-channel radio operating between 108-132 M/cs and will be equipped for quick conversion into ambulance aircraft. They will operate with skis in the winter.

707's THOUSAND.—On July 25 the Boeing 707 prototype (the "dash 80") completed 1,000 hours of test flying in a period of four years. It flew for the first time on July 15, 1954.

Commercial Aviation Affairs

BOEING CERTIFICATE.—The Boeing 707-120 series of transports was granted a provisional C.A.A. type certificate on August 15, when the first aircraft was handed over to Pan American. In this picture the aircraft keys are accepted by Mr. S. Kauffman (centre) for P.A.A. from Mr. J. B. Connelly, while Mr. K. Mitchell looks on. A proving flight from New York to London by P.A.A. 707 is tentatively planned for September 7. Scheduled transatlantic service is to start in November.

INVESTIGATING B.W.I.A. — Air Commodore G. J. Powell has been appointed by B.O.A.C. Associated Companies to undertake a review of the organization and methods of B.W.I.A. in all its departments and establishments. B.W.I.A. has recorded a loss in each of the last five years, and has been affected by a pilots' strike, last October, and a falling-off of tourism from the U.S.A. to the Caribbean. Air Commodore Powell retired as managing director of British Aviation Services and associated companies last year through ill health. He will submit a report and recommendations to the boards of B.W.I.A. and B.O.A.C. Associated Companies.

Next Week

THE AEROPLANE for September 5 will be a 60-page issue largely devoted to first impressions of the S.B.A.C. Show at Farnborough. It will contain a report on the Tuesday's flying display, a survey of the aircraft, engines and missiles at the Show, and an illustrated feature by WREN on Farnborough's Air Traffic Control arrangements.

Supporting this report will be various special articles; eight pages of cutaway drawings of aircraft and engines. There will also be a report on the Astronautics Conference at Amsterdam.

This issue will cost the usual 1s. 6d. and can be obtained from all bookstalls and booksellers or direct from the publishers, Temple Press Limited, Bowling Green Lane, London, E.C.1.

DELHI-MOSCOW.—On August 14 an Air India International L-1049 landed at Vnukovo Airport, Moscow, after completing the first scheduled service from Delhi, via Tashkent. The first service by Aeroflot, with a Tu-104, left Moscow for Delhi on August 18.

TRAFFIC DECLINE.—U.S. domestic passenger traffic in the month of July was 0.8% less than that for the same month of 1957. This was the third consecutive month in which traffic declined from the 1957 level, although the drop was less severe than for May and June.

AER LINGUS IN 1957-58.—For the year ended March 31, 1958, Aer Lingus showed an operating surplus of £33,719 and, after deductions for superannuation and interest and additions for profits on the sale of aircraft and other equipment, a credit balance of £32,654 remained. The overall revenue load factor was 64.6% and the break-even factor was 68.9%. Fewer passengers were carried than in the previous year — 441,363 against 457,609—a fact attributable to B.E.A.'s participation in U.K.-Dublin services as well as to the slowing down of the traffic growth-rate.

SOVIET CONSORTIUM?—According to an unofficial report from Warsaw there is a possibility that air transport behind the Iron Curtain may be unified in a single organization. Such a consortium would include the Czech C.S.A., Polish LOT, Hungary's MALEV, Bulgaria's TABSO, Rumania's TAROM and East Germany's Lufthansa.

FAST FLIGHT.—On its return from a proving flight to Japan, one of Canadian Pacific Airlines' Bristol Britannia 314s covered the 4,700 miles, Tokyo-Vancouver, non-stop in 13½ hours. The Britannia services on this route were due to start last week-end.

LOOKING AT THE JETS.—The 11th annual Technical Conference of IATA will be held at Monaco from September 9 to 16. The principal items on the agenda will be the engineering problems posed by turbine-powered aircraft; the practical air traffic control requirements for the next five years; an exchange of information on instrument approach and landing techniques; and aircraft structural problems. Capt. J. W. G. James, B.E.A., chairman of the IATA Technical Committee, will preside.

COMETS FOR AFRICA?—Reports from Nairobi say that the East African Airways Corporation is proposing to purchase a "small number" of Comet 4s for use on services between London and Nairobi and paralleling those of B.O.A.C.

REAR-FACING SEATS.—The Australian Air Navigation Order of January, 1955, requiring the fitting of rearward-facing seats on all new aircraft introduced after January 1, 1957, has now been deferred. The Australian representative at ICAO's airworthiness division meeting last year did not get adequate support for the requirement and the Order will not now be enforced until some international agreement has been reached on this important matter.

DC-6s GROUNDED.—National Air Lines has grounded its DC-6 fleet for inspection, *Aviation Daily* reports, following discovery of fatigue failure in the front spar-to-fuselage fitting on the vertical stabilizer. On investigation, four of National's DC-6s were found to be defective, and Douglas has recommended all operators to make an immediate inspection. A general grounding has not been ordered.

A.R.B. NOTICES.—The Air Registration Board announces the issue of the following Notices to Licensed Aircraft Engineers and to Owners of Civil Aircraft: No. 4, Issue 23, No. 16, Issue 5 and No. 52, Issue 1. All are dated July 18, 1958.

News About People

CANADAIR CHANGES. — Mr. Edward H. Higgins, who has been senior engineer (aircraft) of Canadair, Ltd., in Montreal, for the last 11 years, has been appointed chief engineer of the company and deputy to Mr. W. K. Ebel, vice-president (engineering). Mr. Higgins succeeds Mr. E. B. Schaefer, who died on July 9. The new assistant chief engineer for administration is Mr. Thomas A. Harvie, who was formerly project engineer on the CL-28 and CL-44 aircraft.

AUTOMOTIVE POSTS. — New appointments have been made within the organization of the Automotive Products Co., Ltd., effective as from August 1. Mr. B. G. L. Jackman is appointed director of the Lockheed Hydraulic Brake Co., Ltd.; Mr. C. Webster becomes executive director in charge of the export division, and Mr. A. R. W. Murray becomes secretary of the holding company, Automotive Products Associated, Ltd., in addition to his present responsibilities as executive director and secretary of the Lockheed Hydraulic Brake Co., Ltd., Borg and Beck, Ltd., and the Automotive Products Co., Ltd.

CELLON DIRECTOR.—Mr. R. J. Ledwith, B.Sc., F.R.I.C., has been co-opted to the board of directors of Cellon, Ltd. He has been with the company for 31 years.

WEAPONS RESIGNATION.—Mr. H. J. Brown has resigned his post as controller of the Weapons Research Establishment at Salisbury, South Australia, to join a Melbourne electronics firm.

LEAVING AVIATION.—Mr. Tom C. Wallace has retired after 11½ years as sales manager, aero sales division, of Alvis, Ltd. He is now to live in the Orkneys.

K.L.M. EXECUTIVES.—Mr. M. J. van der Ploeg is, at his own request, retiring from the board of K.L.M. on October 1. Mr. T. M. van Erp is to be industrial director of administration, Mr. P. A. H. Schlingemann general secretary, and Mr. C. J. N. Nass chief of foreign relations.

(*Continued on page 285*)

Charles Dollfus

OUR contemporary, *Les Ailes*, reports the retirement of Charles Dollfus, the popular custodian of the Musée de l'Air in Paris. As most aeronautical historians will know, Dollfus *is* the Musée de l'Air and it is difficult to imagine the one without the other.

Born on March 31, 1893, he became interested in aeronautics early in life, and in 1911, at the age of 18, made his first ascent in a balloon. Two years later he became a balloon pilot and, in 45 years, has made more than 340 ascents. He is also a dirigible pilot, and has used all forms of heavier-than-air aircraft. He is, therefore, one of the few—if not the only man alive today—who has used all the different forms of air transport.

In 1918, in collaboration with Louis Hirschauer, he started to collect historical material to form the Service des Collections de l'Aéronautique which laid the foundation of the Musée de l'Air, of which he became director in 1927.

From 1919 until 1939 he produced in association with Hirschauer "L'Année Aéronautique" and in 1932, with Henri Bouché, he wrote "L'Histoire de l'Aéronautique," perhaps the most famous of all aeronautical histories and a much-sought-after collector's piece.

He is succeeded as "Conservateur" by Col. Edmond Rougevin-Baville and it is hoped that he will succeed, where Dollfus failed, to get the Musée established in a permanent home in Paris.—F.H.S.

B.O.A.C. POSTS.—Mr. Leslie Hyland, who has been on secondment to British West Indian Airways as assistant general manager and who has been responsible for the commercial organization, succeeds Mr. George Boughton as B.O.A.C.'s sales manager, Western Routes, as from August 25. Mr. Boughton, who began in civil aviation with Imperial Airways in 1935, is to become chief executive of B.O.A.C.'s associate company, Kuwait Airways.

PUBLICITY CHIEF. — Desoutter Brothers, Ltd., has appointed Mr. R. F. Belcher as publicity manager in succession to Mr. P. Allen. Mr. Belcher was formerly with Decca Radar, Ltd.

P.R.O. FOR A.A.—Mr. Willis Player, a vice-president of American Airlines, Inc., is to head the company's public relations department. He succeeds Mr. Rex W. D. Smith, Jnr., who has been vice-president, public relations, since 1946.

ICAO ATTACHMENT.—Mr. H. S. C. Rigby has been loaned by M.T.C.A. to ICAO for an initial period of one year. He will be in charge of the organization's technical assistance mission to Pakistan. Mr. Rigby formed the then M.C.A.'s GCA school at Aldermaston in 1947 and was a U.K. delegate at ICAO's Second Air Navigation Conference in January, 1956.

AERO SALES.—Mr. C. W. Lane, M.S.L.A.E., has been appointed sales manager of Palmer Aero Products, Ltd. (Aero Products Division—BTR Industries, Ltd.). Previously Mr. Lane was with Vickers-Armstrongs (Aircraft), Ltd., where he was responsible for handling flight testing and development of military and civil aircraft at the Wisley works.

SYWELL EXTENSION.—Gp. Capt. D. R. S. Bader, C.B.E., D.S.O., D.F.C., is to open the new airport restaurant at Sywell Aerodrome, Northampton, at 12.00 hr. tomorrow, August 30. The aerodrome is operated by Sywell Aerodrome, Ltd., of which Lt.-Col. G. R. D. Shaw is chairman.

ANTIPODEAN GUIDANCE. — Newly elected chairman of the International Airline Navigators Council (whose offices are at Box 162, Levittown, N.Y., and 36 Alfred Street, Milsons Point, N.S.W.) is Mr. W. W. Wilson, a navigator with Qantas. He was formerly vice-chairman of the Australasia region of the council.

VISITING GERMANY. — Mr. R. Goodburn and Mr. W. H. Dothie of Simmonds Aerocessories, Ltd. (a member of the Firth Cleveland Group), are to visit Frankfurt this month to discuss with agents and customers the sales and promotion of the company's products.

VERTOL DIRECTOR.—Mr. Felix A. Kalinski, vice-president of the Vertol Aircraft Corpn., has been elected a member of the board of directors.

COL. E. MEILLE.—We regret to record the death, in a flying accident on June 14, of Col. Enrico Meille, of the Italian Aeromere S.p.A. company. He was a frequent visitor to U.K. flying meetings and competitions.

A Pioneer Dies

DR. WILLIAM FREDERICK DURAND, F.R.Ae.S., Hon. F.I.A.S., who died on August 10, at the age of 99, was known throughout the aeronautical world as the editor of the six-volume "Aerodynamic Theory." What is not known so well is that the editing of this monumental work, besides most of the other research for which he is known, was done when he passed the age of retirement.

After graduating from Annapolis he served seven years in the U.S.N. where his scientific curiosity was aroused by the "hit-and-miss" design of propellers. From research in this direction it was a short step to aeronautics and he became one of the original 12 forming NACA (1915). During the First World War he was this body's chairman and afterwards continued his researches into aircraft propellers at Stanford.

He "retired" in 1924. A measure of his achievement since that date can be gained from the years of his honours. The Guggenheim Medal (1935), the John Fritz (1935), the Franklin (1938), the John J. Carty (1944), A.S.M.E. (1945), Medal of Merit (1948), and Wright Brothers Trophy (1949). He delivered the sixth Wilbur Wright Lecture in June, 1918. —F.H.S.

Military Aviation Affairs

R.A.F.A. DISPLAY. — Tomorrow, August 30, the Colwyn Bay branch of the R.A.F. Association is to stage a 40-min. air display for visitors to Eiras Park. Air Marshal Sir Richard Atcherley, A.O.C.-in-C., Flying Training Command, will be present. The display, which begins at 15.00 hr., will include Hunter aerobatics by No. 56 Sqn., led by Sqn. Ldr. R. J. S. Dickinson, the C.O.; aerobatics by four Jet Provosts of the C.F.S. and a Vampire T.11 demonstration.

TEMCO DELIVERIES.—Six Temco TT-1 primary jet trainers have been delivered to Saufley Field, Pensacola, Fla., for Navy evaluation of the all-jet training syllabus. The TT-1 operates at 235 knots and has a maximum diving speed of 450 knots. The landing speed is 70-75 knots.

MORE NEPTUNES.—The Lockheed Aircraft Corpn. has received a U.S. Navy contract, worth about £8 million, for 26 P2V-7 Neptune anti-submarine aircraft and equipment. Production of the Neptune will thus be continued up to September, 1960. Since the prototype was produced in 1944 27 orders for the type have been given. The P2V-7 has two Wright turbo-compound engines and two J34 turbojets for take-off or emergency boost.

GRUMMAN ORDER. — The U.S. Army has given an order to the Grumman Aircraft Corpn. for 35 two-seat AO-1 Mohawk observation aircraft. The type, powered by two Lycoming T53 turboprops, was illustrated in THE AEROPLANE of July 18 last.

HIGH-SPEED TOWING.—This Gloster Meteor TT.20, among the first in Royal Navy service, was seen at R.N.A.S. Ford recently. It belongs to No. 700 Squadron at Hurn, and is operated for that squadron by Airwork, Ltd.

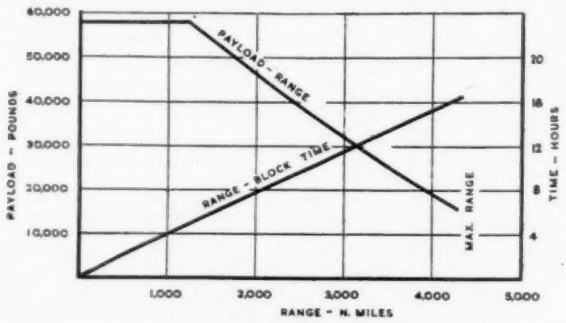
N

Blackburn B.107 Military Transport

LARGER and faster than the Beverley from which it is developed, the Blackburn B.107 is a projected military transport which also has a much greater range and payload. It is powered by four Rolls-Royce Tyne turboprops and has a maximum all-up weight of 175,000 lb.—40,000 lb. greater than that of the Beverley.

Carrying payloads of 50,000 lb. over 1,750 nautical miles and 20,000 lb. over 3,925 nautical miles, the B.107 can fly on long-range strategic routes: at the same time it retains the Beverley's ability to operate tactically from very short, rough airstrips. It can act both as a strategic troop carrier and heavy freighter and in the tactical rôle can be used for supply-dropping, paratrooping, casualty evacuation, and flying troops and heavy equipment into and out of small airstrips.

The wing and tail unit of the B.107 are similar to those of the Beverley but, as the three-view drawing on page 319 shows, the aircraft has an entirely new fuselage. This is pressurized and has a double-bubble section from the nose to the wing. The aircrew are on the upper deck; below them the nose of the fuselage is formed by large doors which can be opened for the



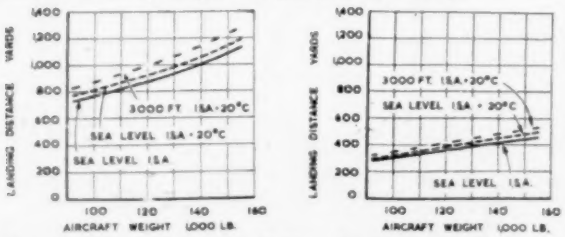
This range and payload graph for the B.107 is based on take-off at 175,000 lb. all-up weight and operation in I.S.A.+20°C. conditions. Fuel reserves allowed are 6¼% of the fuel used during take-off, climb, cruise, descent and landing plus fuel for a 200-naut.-mile diversion with a 30-knot headwind plus fuel for 30 minutes holding at 1,000 ft.

loading of vehicles and freight. Floor width at these doors is 11 ft. 7 in. and the height of the opening is 11 ft. 3 in.

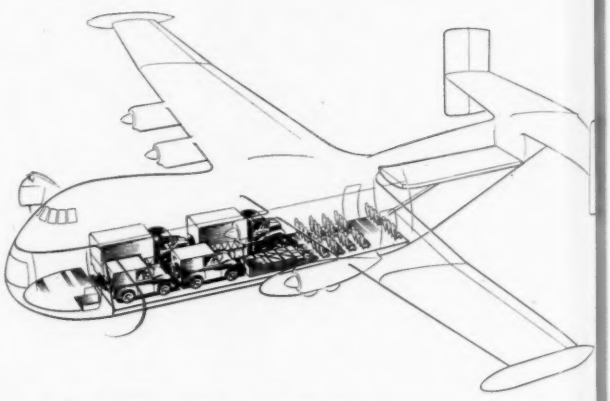
The fuselage interior has a freight floor which is 12 ft. 7 in. wide and 59 ft. 4 in. long with a maximum height of 11 ft. 4 in. At the rear of this floor is a large door which can be opened in flight for the dropping of supplies and heavy equipment; this door is 10 ft. wide and 9 ft. high. Despite these large doors the fuselage is pressurized to a differential of 6.5 p.s.i.

The freight floor has an overall strength of 250 lb./sq. ft., but local concentrated loads up to 3,600 lb./sq. ft. can be accepted. Seat and freight tie-down fittings of 10,000 lb. ultimate strength are provided on a 20-in. grid. Freight and vehicles can be loaded through both front and rear doors; if the rear door is not used the space above it is available for light freight or the fitting of a removable galley and toilets.

The main undercarriage has eight-wheel bogie units which retract into tear-shaped fairings attached to the sides of the fuselage. The nose undercarriage is a twin-wheel unit. Tyre pressure for operation at maximum all-up weight of 175,000 lb. is 75 p.s.i. For tactical operation into small airstrips at 150,000 lb. all-up weight, the tyre pressure is 66 p.s.i.



Landing distance from 50 ft. (left), and ground run (right), are shown above.



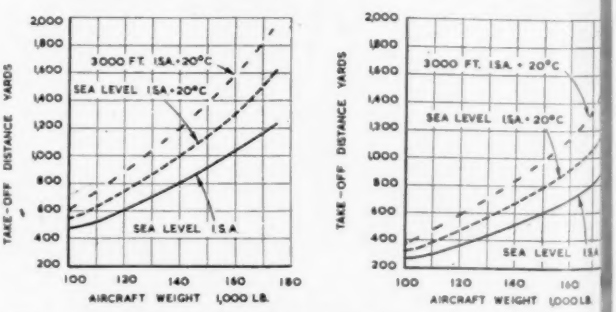
As a mixed-load transport the B.107 will carry two 1-ton trucks, two Champs and 30 troops over a stage distance of 2,200 naut. miles.

Rôles and Loads

In its strategic rôle the B.107 can carry a 36,000-lb. payload between Britain and Australia. Flying via Kano, Entebbe, Mauritius and Cocos Island to Adelaide, a total distance of 10,900 nautical miles, the B.107 would cover the route in just under 42 hours' flying time. Its maximum cruising speed is 352 m.p.h. at 25,000 ft.

For heavy freighting a typical load would be six fully-laden Ferret scout cars, weighing 58,000 lb. with their tie-down equipment. With full R.A.F. Transport Command fuel reserves this load can be flown from a 1,450-yd. runway at sea level in I.S.A. conditions and carried over a stage distance of 1,250 nautical miles.

Another load could be two Prestwick Pioneer aircraft, 12 aircrew and engineers, and a detachable galley. These together weigh 14,000 lb.; only a 600-yd. ground run would be necessary



These graphs give the B.107's take-off distance to 50 ft. (left) and take-off ground run (right).

if this load were to be flown over a stage distance of 3,000 nautical miles. A similar load would be two Bristol Sycamore helicopters with spares and tools.

A typical mixed load which the B.107 could carry is illustrated above. It is two 1-ton trucks, two Champs and 30 troops. When loads of this nature are carried the seats are fitted behind the vehicles for safety. These seats do not have to be moved when freight is loaded or unloaded because it passes through the doors at the fuselage nose.

In the trooping rôle 108 men can be carried six-abreast in aft-facing seats pitched 36 in. apart. This load, including the seats and furnishings, weighs 28,700 lb. When the B.107 is operating from a 1,450-yd. runway the 108 troops can be flown over a maximum stage length of 3,250 nautical miles.

For casualty evacuation the B.107 will transport 92 patients on stretchers and nine medical attendants. Galley, toilet and baggage facilities and medical stores are provided and an electrical supply is available for heated blankets and iron lungs.

(*Continued on page* 287)

(*Continued from page* 286)

This load, including furnishings, weighs 30,000 lb. Flying from a forward airstrip which permitted a 600-yd. ground run, the B.107 would carry it over a 1,600-nautical-mile stage distance. If the take-off were from a 1,450-yd. runway this stage distance could be increased to 3,150 nautical miles.

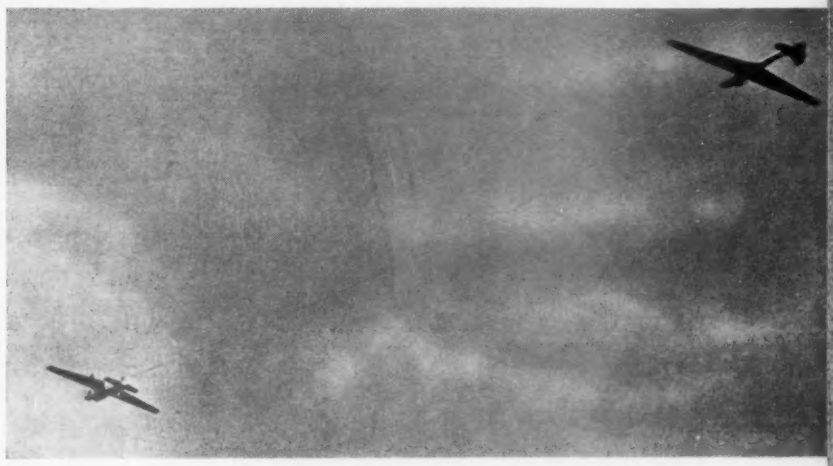
In the paratroop rôle the B.107 carries 75 troops and their bags with three dispatchers. Seats are arranged so that two columns of men jump simultaneously from side exits; the stick length would be about 1,900 yd. If take-off were from a 1,450-yd. runway these paratroops could be dropped up to 1,600 nautical miles from the base airfield. Heavy equipment for airstrip construction can also be air-dropped by the B.107.

Take-off, landing and range/payload performance of the B.107 are given in the graphs on page 286. Overall dimensions and a performance summary appears on page 319.

New From Czechoslovakia

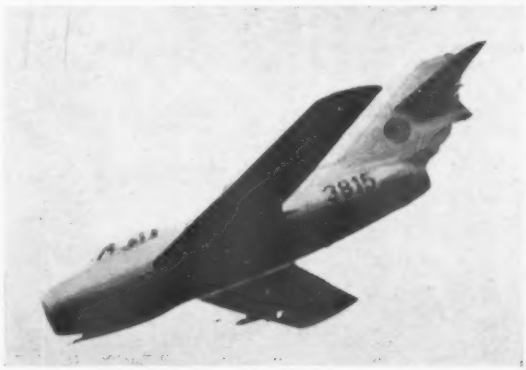
A number of new and interesting aircraft, several of which are described on the next page, were to be seen at Bratislava during the recent Parachuting Championships.

Photographs copyright "The Aeroplane"

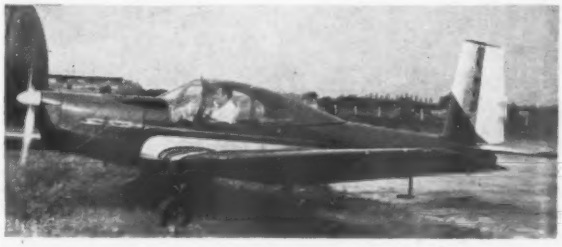


Above, one of the most startling exhibitions of flying yet seen were the aerobatics during continuous tow of this Zlin Trener and VT-7 sailplane.

Below, CSA, the Czech airline, is already using the Morava L200 as an air-taxi, but major production, with the more powerful Walter Minor M-337, will not start until next year. Since the prototype first appeared, a dorsal fuselage fin has been added to improve stability.



Above, fitted with underwing smoke containers, this MiG-17 *bis* ("Fresco-C") of the Czech Air Force made several low reheat runs over Vajnory airfield during the opening display.



Left, the initial production batch of three-seat L-40 Meta-Sokols with their reversed tricycle undercarriage have the 105 b.h.p. Walter Minor 4-III, but the next series will have the 140 b.h.p. M-332, and carry four people.

Above, the Hungarian parachute team brought along its own An-2 to Bratislava. Most of the Satellite countries are equipped with this type.

Left, another Czech Air Force visitor to Vajnory was this Mil Mi-4 ("Hound") helicopter, which was gingerly demonstrated in flight.

Display Items in Bratislava

AUGUST 3, the opening day of the recent World Parachuting Championships (THE AEROPLANE, August 15 and 22), coincided with Czech Aviation Day, which was marked by an extensive display programme at Bratislava.

Unfortunately, the first part of the afternoon's activities, including the normally impressive opening parade, with national flags, etc., was accompanied by a no less impressive deluge, during the speeches by the president of the Czech Aero Club, Karel Grepl, and Mr. H. R. Gillman, of the F.A.I.

Flags of the F.A.I. and Czech aero clubs were flown past by six Bücker Bestmann monoplanes (C-106s), followed by a Yak-12 towing a banner inscribed with "For Friendship Among Nations." An impressive item was a formation of C-106s in the pattern of a parachute, with a big An-2 "suspended" below, while behind some K-63s formed the figure "IV" to represent the Fourth Championships.

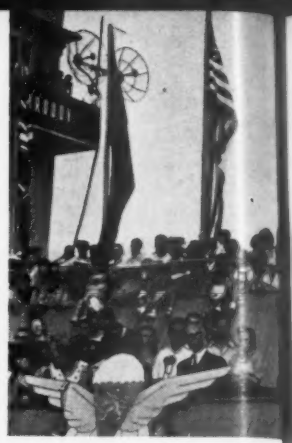
Some startling aerobatic demonstrations, including bunts, tail-slides and low inverted runs were given by VT-7 sailplanes, but even more sensational was a glider of similar type which went through a similar routine while remaining on tow behind a Zlin Z226T. The VT-7 not only followed the Zlin through inside and outside loops, inverted turns, rolls, etc., but also performed several manœuvres independently, so that sometimes the sailplane was inverted while the tug was the right way up, and vice versa. This quite outstanding performance was given by Jaroslav Hudec and Frantisek Novak.

Zlin Treners were aerobatted individually and in formation by Czech men and women pilots, including Krysta and some of the other aero club members who recently visited Coventry for the Lockheed aerobatic competition.

Czech and Hungarian Yak-11s, also flown by men and women pilots, performed individual and group aerobatics, and there were formation and tail-chasing manœuvres by a number of C-104s (Czech-built Bücker Jungmanns), which did a continuous loop right across the airfield. A Czech Air Force Mil Mi-4 helicopter was cautiously demonstrated, and the remaining military participation comprised an impressive and prolonged beat-up by an afterburning MiG-17 trailing red smoke from underwing canisters, and a mass descent, from three Dakotas, of some 60 paratroops, most of whom landed in the crowd.

Several new Czech light aircraft were demonstrated by their test pilots, including the Morava L-200, a handsome successor to the Super Aero 45 (one of which was dived low over the airfield with both airscrews feathered), and the Zlin Z326—a Trener with a retractable undercarriage. The crop-spraying Brigadyr, which resembles an all-metal Fieseler Storch, was also demonstrated in the improved weather of the late afternoon.

During the course of the Championships, a small but well-presented static display of Czech aircraft, engines and equipment was held in Bratislava by Omnipol, the national aircraft export organization. Largest item was the stripped fuselage of a Zlin Z226 Trener, and there was also a display of models of some of the newer aircraft. The five-seat L200, which is the most modern Czech light aircraft, is already in service as an air-taxi, in its pre-production series, with CSA, the Czech airline, but the main series will have modified Walter Minor 6-III engines incorporating fuel injection.



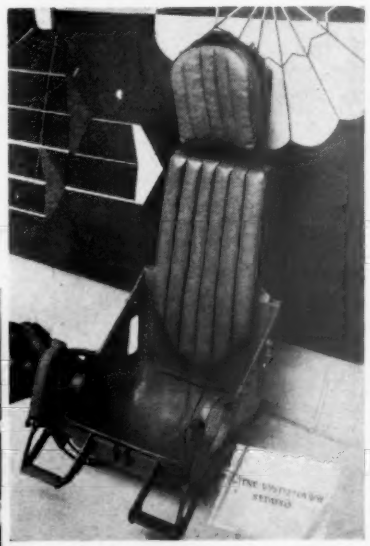
The Director-General of the F.A.I., Mr. H. R. Gillman, attended the Fourth Parachuting Championships at Bratislava, and is here seen speaking at the closing ceremony.

The M-337, as the modified engine is designated, was displayed at Bratislava, and will have its power increased from the 160 b.h.p. of the Walter Minor 6-III to about 200 b.h.p. On the same basis was shown the Walter M-332, which is a Walter Minor 4-III with fuel injection and its power increased from 105 to 140 b.h.p. The M-332 will be fitted in the new production series of the LD40 Meta-Sokol, which has hitherto been flying with the 105 b.h.p. Minor 4-III, and will make it a full four-seater instead of carrying only two passengers plus pilot. Delivery of the new LD40 series begins in October, 1958, and of the production L200 in late 1959.

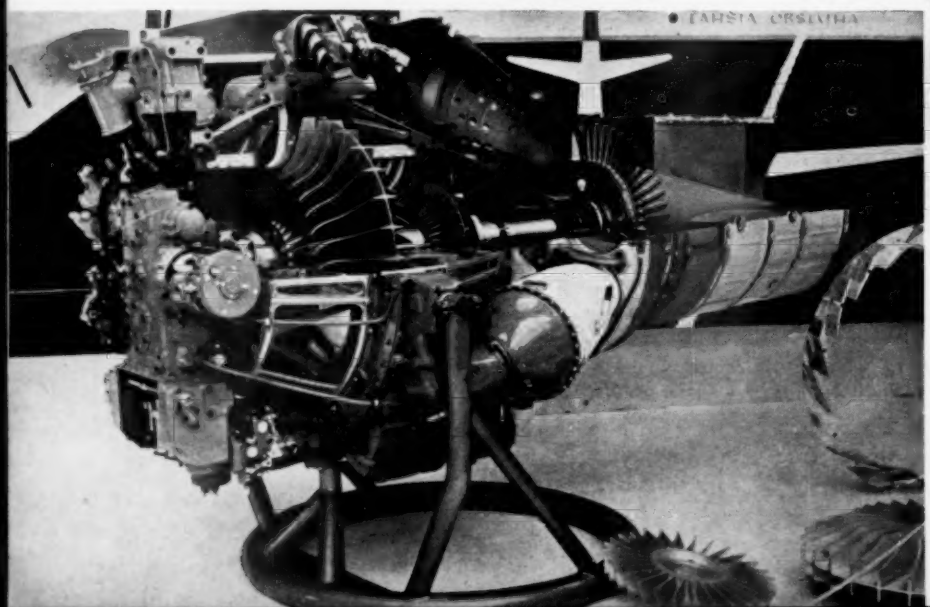
Powerplant for the L60 Brigadyr, the 220-b.h.p. Praga Doris B flat-six engine appeared to be a very compact, efficient and up-to-date design, incorporating reduction gearing. The only turbojet exhibited was the Czech-built Russian-adapted Rolls-Royce Nene, fitted to the MiG-15 and 17, and designated in Czechoslovakia the M05. Workmanship on all display items appeared to be good, although possibly slightly inferior to Western standards.

In addition to V-410 and V-415 airscrews, for engines of up to 200 and 60 b.h.p. respectively, other exhibits included PTCH blank-gore training and sports parachutes and ZL-55 emergency packs. An ejection-seat from a MiG-15 was also shown, but no details of its performance were available. With its trigger actuation and lack of pilot protection, it appeared to differ very little from the early German (and many current American) models.

To conclude the Parachuting Championships, a slightly smaller flying display, with many repetitive items, was held at Vajnory, Bratislava, and once more the crowd enjoyed the towed aerobatics of the Z226 and VT-7. A MiG-15 *bis* joined the MiG-17 from a nearby jet airfield, and both made some sizzling high-speed runs low across the airfield, while all the contestants made up mixed sticks in the An-2s to jump with each other's equipment. An appropriate finale was the descent, from the An-2 at the base of the pattern-flown parachute, of two more parachutists.—J.E.F.



Right, on show in Bratislava, this MiG ejection seat appeared to offer very little in the way of pilot protection and low altitude performance.



Left, one of the most informative exhibits at Bratislava was this sectioned Czech-built M05 turbojet, used in the MiG fighters and directly adapted from the Rolls-Royce Nene.

Photographs copyright "The Aeroplane"

Air Transport

A Record B.E.A. Profit

DURING recent months we had become so accustomed to the tales of economic woe from the World's airlines that even the expected news that British European Airways had returned a record profit for 1957-58 came as something of a pleasant surprise.

Of course, the annual period covered—April 1 to March 31—included only a part of the airlines' recession period and an extremely good 1957 summer period, coupled with a vigorous efficiency campaign within the Corporation, explains what might appear, at first sight, to be almost a unique result. The current year is likely to show disappointing results by contrast and even those for 1957-58 would have been a good deal better if the later months of the financial year had not been so relatively unfruitful.

Nevertheless, it would be interesting to make a detailed investigation into the varying results of our two nationalized airline corporations during the past 10 years or so and to be able thus to see exactly why one could be doing well while the other was doing so relatively badly. The various explanations given for failures during the years did not always tell the whole of the story for either of our corporations with their curious swings of annual fortune.

The details of B.E.A.'s results can be seen in the tables on this and the next page which summarize the more important of the financial and operating results. Briefly, the profit after interest had been paid was, at £1,054,807, the highest in the Corporation's history and was nearly half a million pounds better than the best previous figure—for 1955-56. Expenditure rose by nearly 15%, but revenue rose by 18.3%, with very nearly a 14% increase in traffic over the whole period in spite of a winter-period increase of only about 6%. Perhaps the most significant feature of the results is that the capacity ton-miles per employee rose by nearly 10% on the figure for the previous year.

Some 77% of the revenue came from international services and the overall position of the domestic services did not improve on that for previous years. Nevertheless, the biggest increases in passenger traffic were those on services between the provinces and the Continent (36%). B.E.A. slightly increased, to 58%, its share of all normal U.K.-Continent scheduled traffic, though the share of total traffic dropped two points to 42%. The passenger load factor on international services was, at 67.9%, the highest for any major European operator. Freight traffic rose only 7% by comparison with the previous year's increase of 21%.

The effects of the summer/winter variations in traffic can best be seen by noting the fact that, using 100 as a datum figure for the six winter months, summer traffic varied in ratio, according to type of service and route, from 126 to 272, with domestic service variations of the order of 150-200.

The report points out that two important decisions must soon be made by European operators—on the number of classes to be agreed and on fare differentials by type. For the first, B.E.A.

OPERATING RESULTS

	1957–58	1956–57	Change
			%
Capacity ton-miles (C.T.M.s) offered	160,281,788	139,078,802	+15.2
Load ton-miles (L.T.M.s) sold	102,062,347	89,685,423	+13.8
Revenue load-factor	63.7	64.5	−1.3
Load-factor to cover total expenditure	61.3	63.9	−4.1
Cost per C.T.M. (pence)	40.9	41.0	−0.2
Revenue per C.T.M. (pence)	42.4	41.3	+2.7
Revenue per L.T.M. (pence)	66.6	64.1	+3.9
Number of passengers	2,765,591	2,461,065	+12.4
Revenue passenger-miles	935,755,877	808,872,028	+15.7
Available seat-miles	1,365,093,800	1,150,792,379	+18.6
Passenger load-factor	68.5	70.3	−2.6
Mail ton-miles	3,599,500	3,622,641	−0.6
Freight ton-miles	9,925,764	9,227,790	+7.6
Number of employees	11,011	10,501	+4.9
C.T.M.s per employee	14,557	13,244	+9.9

Note : Tons=short tons (2,000 lb.)

PROVEN PAIR.—Still the only turboprop transports in regular passenger service anywhere in the World, the Bristol Britannia (top) and Vickers Viscount are among the aircraft which have contributed to Britain's success in the export market (see page 292). These new photographs show the Britannia and Viscount in the markings of two North American operators—Canadian Pacific, who have six Britannias, and Northeast Airlines, who have purchased nine Viscounts.

suggests that two classes will be adequate; for the second, the Corporation comes out unequivocally on the side of differentials. Such variation in fares is believed by the Corporation to be essential if expensive re-equipment competition is to be avoided. In another part of the report, B.E.A. suggests that the lives of aircraft should be extended and the rates of re-equipment slowed down to deal with the airlines' low-profit-margin problem.

Dealing with new equipment, the report has one or two new things to say about the Vanguard and the Comet 4B. The former are to be laid out as 105-seaters with accommodation for 18 first-class and 87 tourist-class passengers—showing a significantly low ratio for future first-class travellers. The Vanguard's navigation and radio equipment will, incidentally, be repeated in the Comet, which will be planned with a three-crew flight deck and with passenger arrangements including a 67-seat mixed-class version and a 102-seat high-density version.

FINANCIAL RESULTS

	1957–58	1956–57	Change
			%
Traffic revenue	£27,352,057	£25,080,678	+18.5
Total operating revenue	£28,340,725	£23,947,774	+18.3
Expenditure on operating account ..	£26,465,070	£23,023,008	+15.0
Total expenditure	£27,285,918	£23,742,049	+14.9
Operating profit	£1,858,887	£807,285	+130.3
Profit	£1,054,807	£205,725	+412.7

Development work by the helicopter unit has included that on autostabilizer/flight director equipment; microwave ILS and Decca approach systems; VOR; and approach-light systems. An explanation of the helicopter approach-lighting system (laid down near the old "beehive" terminal building at Gatwick Airport) and some comments about this system and about the use of Decca appeared in THE AEROPLANE of April 4, 1958.

B.E.A. Retires the Elizabethan

ON July 30 the last scheduled service by a B.E.A. Elizabethan was flown from Hanover to London. Although there is plenty of life left in the 18 aircraft of this type which will no doubt continue in service with other operators, this date marks the end of a history which was both sad and happy. It was sad because, as the Airspeed A.S. 57 Ambassador, the Elizabethan might have had a great airline future if all had gone well, and happy because, in B.E.A.'s fleet, it did excellent service through its 6¼ years of operational life.

Twenty Ambassadors were built for B.E.A. and the first entered scheduled service, as the Corporation's first modern pressurized airliner, on the London-Paris route on March 13, 1952. Before then, two prototypes and one pre-production prototype had been built by Airspeed at their Christchurch factory. The first of these prototypes flew on July 10, 1947, and the remaining two are still doing good work as flying test-beds with Rolls-Royce and Napier respectively.

No more than the 20 production aircraft were built—though, at the time when the decision was made to cease production, two or three airline operators in addition to B.E.A. were interested in the Ambassador. Today, ex-B.E.A. Elizabethans are in service with B.K.S. Air Transport in England and with Ansett-A.N.A. (Butler Air Transport) in Australia.

During the 6¼ years with B.E.A., Elizabethans have proved extremely popular with passengers and the average passenger load factor has been 67.5%. In all, about 2,430,000 passengers flew in this pleasant, high-wing aircraft and something like 178,000 flying hours were logged in B.E.A. service. Its Bristol Centaurus piston engines have reached an inter-overhaul life of 1,700 hours, even though there were never more than 40 engines of this type in airline service at any one time.

Monumental Ice Accretion

AN incident early last January, involving an aircraft crossing the Alps from south to north, gives some idea of the weight and rapidity of ice accretion which is possible in certain conditions.

According to the pilot's report, the aircraft was flying at 20,500 ft. near Mt. Blanc at an airspeed of 200 knots and with an outside air temperature as low as minus 27°C. when there was a sudden loss of engine power accompanied by very heavy rime icing. The ice formed so quickly that it was as if the entire mass had formed instantaneously, and the amount can be judged by the fact that the formation on the windshield was in the form of "numerous rough opaque pillars" projecting forward some six to eight inches.

The heavy formation was cleared from the leading edges, but the water had run back and re-frozen in a lumpy formation on the upper surface of the wings. Some 600 ft. of height was initially lost, but this was regained with the use of full power, though the airspeed when flying level was only 125 knots. After flying for some 10 minutes in the clear the speed built up to 170 knots, and, finally, to the original 200 knots.

Apparently this kind of very heavy and sudden icing can occur at very low temperatures when a well-developed warm front, associated with vigorous air circulation, crosses high ground. A deep layer of saturated air is thus caused to lift over the high ground, bringing large water droplets up to altitudes of 20,000 ft. or more.

A warning about this dangerous meteorological condition, with quotations from the pilot's report and from a Meteorological Office analysis are given in a recent M.T.C.A. information circular (No. 66).

European Traffic Trends

AS complete traffic statistics for the various airlines operating in Europe are not available on an individual carrier basis, it is necessary for us to amend somewhat the series of quarterly statistics on this subject which we began publishing in THE AEROPLANE for January 31, and continued in our issue for May 2, 1958. In future, we shall be concerned with the total traffic of the European operators who make use of the facilities of the Air Research Bureau in Brussels—comprising Aer Lingus, Air France, Alitalia-L.A.I., B.E.A., Lufthansa, Finnair, Iberia, Icelandair, K.L.M., S.A.S., Sabena and Swissair.

The statistics are concerned with intra-European traffic—that is to say, international traffic which both originates and terminates at points in the European continent or countries bordering the Mediterranean. The purely domestic operations of the carriers concerned are not included. Statistics for the quarters ending December, 1957, and March, 1958, are given below, compared with these for the same periods a year earlier; and the results are also shown on a moving annual basis.

	4th Quarter		1957 as % of 1956	12 mths. ending		1957 as % of 1956
	1956	1957		Dec. 1956	Dec. 1957	
Seat/km. (million) ..	1191	1463	123	5223	6286	120
Pass./km. (million) ..	668	756	113	3162	3730	118
Pass. load factor %	56.1	51.7	—	60.5	59.3	—
Freight tonne/km. (million)	12.5	13.3	107	42.4	47.6	112
Mail tonne/km. (million)	3.4	3.7	108	11.4	12.9	114

	1st Quarter		1958 as % of 1957	12 mths. ending		1958 as % of 1957
	1957	1958		March 1957	March 1958	
Seat/km. (million)	1189	1469	124	5491	6704	122
Pass./km. (million)	620	686	111	3322	3871	117
Pass. load factor %	52.1	46.7	—	61.4	58.8	—
Freight tonne/km. (million)	11.8	12.1	102	45.0	48.8	108
Mail tonne/km. (million)	3.1	3.4	111	12.1	13.6	113

These statistics show that up to March of this year, the decline in the rate of traffic growth was less marked in Europe than in the U.S.A. In the first quarter of 1958, for instance, passenger traffic was up by 11%, compared with the 3% growth in the U.S.A. in the same period; freight traffic, however, has been more seriously affected by the business recession.

The increase of 24% in capacity offered can be broken down into 8% due to increases in the average seating capacity of aircraft in use; 12% to increased frequencies; and 4% to new routes.

The Fighting Services

Ottawa Memorial

WORK is to start on the construction of the Ottawa Memorial, which will commemorate the 798 members of the Commonwealth Air Forces who died in North America and neighbouring lands and seas and who have no known grave. The central feature of the memorial will be a 10-ft.-diameter sculptured terrestrial globe, supported by three bronze beavers in a pool of water and surmounted by an albatross. A circular paved area will surround this feature, from which will rise two asymmetrical stone walls bearing bronze panels on which the names will be commemorated.

Of the total who died, 454 served with the R.C.A.F., 246 with the R.A.F., 32 with the R.A.A.F., 19 with the R.N.Z.A.F., and one with the R.I.A.F. (now the Indian Air Force). The memorial also records the names of five civilians who served with the wartime Transport Command, 22 with the Ferry Command, and 19 who were with the Civilian Technical Corps.

Air Training Corps Chairman

THE Secretary of State for Air has appointed Mr. W. J. Taylor, C.B.E., D.L., J.P., M.P., as chairman of the Air Training Corps Central Council of Welfare in succession to Lt.-Col. Sir Francis Humphrys, G.C.M.G., G.C.V.O., K.B.E., C.I.E. Sir Francis Humphrys, who has held the post since the formation of the A.T.C. in 1941, has resigned on grounds of age. Mr. Taylor, who is Parliamentary Secretary at the Ministry of Supply, has had a long and close association with the Corps.

The Central Council of Welfare administers the A.T.C.'s welfare funds, other than those subscribed locally for the benefit with the wartime Transport Command, 22 with the Ferry Command, and 19 who were with the Civilian Technical Corps.

R.A.A.F. Flying Training

IT has been announced that the R.A.A.F. Basic Flying School at Uranquinty, New South Wales, is to be transferred to R.A.A.F. Point Cook, near Melbourne, later this year. The Advanced Flying Training School was recently moved from Point Cook to Pearce, Western Australia, because of the high cost of building new jet facilities at Point Cook, and because the Vampire Trainers used at the school would have created an air traffic hazard.

R.A.F. Equipment on Show

EXHIBITS connected with the increasingly greater operating heights and speeds of aircraft and with the development of guided weapons and electronics will be among the features on the R.A.F. stand at the National Radio Show at Earls Court, London, between August 27 and September 6. There will be a full scale replica of the Bloodhound, Fireflash and Firestreak missiles, and a scale model of the Thunderbird ground-to-air weapon.

Other items will include scale models of long-range radar equipment and typical R.A.F. guided weapons stations, and new radar and radio equipment now in service, or being developed. These cover precision approach radar, ground-to-air communications developments, digital transmission equipment, and a display of electronic units from the Royal Radar Establishment, Malvern.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Group Captains: H. Z. Foreman, O.B.E., to Headquarters, No. 12 Group, for technical staff duties; C. R. C. Howlett to Air Ministry for duty in the Department of the Air Member for Supply and Organization.

Wing Commanders: B. L. Davis, M.B.E., to Allied Forces Southern Europe for staff duties; R. M. W. Henderson to Headquarters, F.E.A.F., for administrative staff duties; J. C. Hutton, D.F.C., to R.A.F. Middleton St. George to command the Flying Wing; H. Mansell to Air Ministry for duty in the Department of the C.A.S.; L. R. Mumby, O.B.E., to Headquarters, No. 40 Group, for air staff duties; L. B. Noyes, A.F.C., to Headquarters, Fighter Command, as officer commanding the examining team; B. E. K. Pemperton-Pigott to the R.A.F. College, Cranwell, as chief instructor, Equipment and Secretarial Wing; C. N. S. Pringle to R.A.F. Gaydon for technical duties; E. N. Rooms, A.F.M., to No. 49 M.U. to command; P. N. Sowman to No. 35 M.U. for administrative duties; A. M. Montagu-Smith to Budapest as Air Attaché (with acting rank of Gp. Capt.); M. L. L. Bathe to Headquarters, M.E.A.F., for technical staff duties; A. P. Dottridge, D.F.C., to R.A.F. Goch for operations duties; R. A. B. Ellis, R.C.A.F., to Headquarters, Fighter Command; J. S. Higgins, D.F.C., A.F.C., to R.A.F. Sculthorpe to command and as R.A.F. Liaison Officer; G. T. Lester to Headquarters, F.E.A.F., for administrative staff duties; A. McIlwaine to Headquarters, No. 90 Group, for technical staff duties; V. M. Montanini to Air Ministry for duty in the Department of the C.A.S.; A. McI. Peacock to the R.A.A.F. for administrative duties; P. G. Tyler to Headquarters, 2nd T.A.F., for administrative staff duties; C. V. G. Usher to the Central Servicing Development Establishment for technical duties; P. H. C. Wintle, D.F.C., to Air Ministry for duty in the Department of the C.A.S.

Squadron Leaders: G. Blakeman to Headquarters, Bomber Command, for organization staff duties (with acting rank of Wg. Cdr.); A. H. Chamberlain, A.F.C., to Air Ministry for duty in the Department of the C.A.S. (with acting rank of Wg. Cdr.); C. P. H. Kunkler to Air Ministry for duty in the Department of the Chief of the Air Staff (with acting rank of Wg. Cdr.); A. G. W. Williams to R.A.F. Seletar for technical duties (with acting rank of Wg. Cdr.).

Squadron Officer P. F. Marshall, O.B.E., W.R.A.F., to Headquarters, M.E.A.F., for administrative staff duties (with acting rank of Wg. Off.).

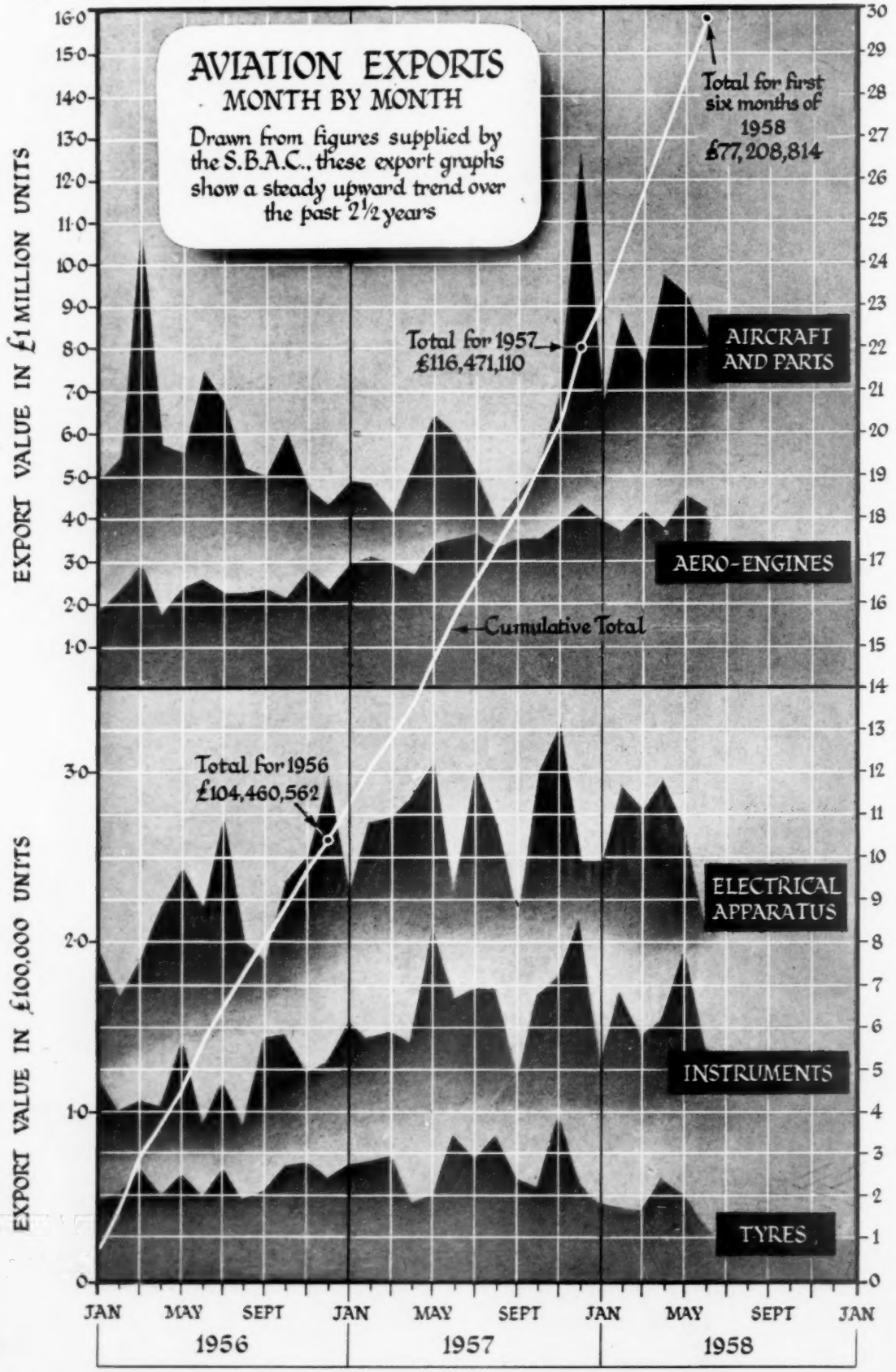
Reunion

M.R.E.S. Officers.—The 10th reunion will be held in London on October 25. For full particulars please write, enclosing stamped addressed envelope, to Sqn. Ldr. P. E. Laughton-Bramley, M.B.E., 18 Cadogan Place, London, S.W.1.

FARNBOROUGH WORK-UP. — Representing the Royal Navy at the S.B.A.C. Show next week are Scimitars of No. 803 Squadron and these Sea Hawks of No. 800 Squadron. Based at R.N.A.S. Brawdy, the Sea Hawk team is led by the C.O., Lieut. Cdr. N. P. Perrett, R.N.

Photograph copyright "The Aeroplane"

The British Aircraft Industry . . . .


AVIATION EXPORTS
MONTH BY MONTH
Drawn from figures supplied by the S.B.A.C., these export graphs show a steady upward trend over the past 2½ years
Total for first six months of 1958 £77,208,814
Total for 1957 £116,471,110
Total for 1956 £104,460,562
Cumulative Total
AIRCRAFT AND PARTS
AERO-ENGINES
ELECTRICAL APPARATUS
INSTRUMENTS
TYRES
EXPORT VALUE IN £1 MILLION UNITS
EXPORT VALUE IN £100,000 UNITS
CUMULATIVE TOTAL IN £10 MILLION UNITS
JAN MAY SEPT JAN MAY SEPT JAN MAY SEPT JAN
1956 1957 1958

CUMULATIVE TOTAL IN £10 MILLION UNITS

BRITISH AIRCRAFT INDUSTRY

Research and Development Prospects

by J. R. Cownie, B.Sc. [Eng.], Grad. R.Ae.S.

NO effective aircraft, missile or space-craft can be built without a background of intensive research and thorough development. In Britain most of this research and development work is based on Ministry of Supply contracts.

Thus in a survey of research and development prospects it is logical to begin by examining M.o.S. policy and how Ministry research facilities work in with those of private industry. This leads to a consideration of the official view of the industry's future, its economic implications and the industrial prospects for military, civil and research projects.

Ministry of Supply Position

The present status of research and development in the British industry is no doubt based on the country's economic position and the policy announced in the 1957 Defence White Paper. M.o.S. policy is also influenced by the December, 1956, report of the Select Committee on Estimates concerning the supply of military aircraft.

Among its recommendations was one that the M.o.S. should try to obtain contributions towards research and development projects from companies working on them. It suggested that companies might contribute 20% of the total cost; this would be returned if the project went into production or was considered to be a success.

The Committee felt that the research-project control system should be reviewed to ensure that projects were not continued after they had outlived their usefulness. The military aircraft programme should be reviewed to ensure that the number of projects was the absolute minimum consistent with security. Steps should be taken, preferably with the agreement of the industry, to limit the number of firms receiving Government contracts for the manufacture of airframes and aero-engines. The M.o.S. should use the method of selective allocation of contracts to bring about the measure of coalescence in the aircraft industry which they agreed was desirable.

This committee issued its report 21 months ago and it appears that many of its recommendations have been adopted by the Ministry.

It is interesting to note that there has recently been a U.S. inquiry into the U.S.A.F. research and development programme. The report of the Stever Committee shows that the U.S. suffers the defects of that country's financial advantages in research and development. The committee criticizes inter-Service rivalry; each of the U.S. Services has worked to establish its future in the air defence, missile and space field. As a result "the rôles and missions of the Services have become competitive rather than complementary."

Research Facilities

Research and development go hand in hand—in many cases it is impossible to separate them. Research in the aircraft and engine field normally has an immediate and practical end in view. Many of the so-called research facilities owned by companies are used mainly for development work and the testing of specific projects.

Research has been classified in three categories by Mr. M. B. Morgan, deputy director of the Royal Aircraft Establishment. *Ad hoc* research is devoted to obtaining new knowledge about the behaviour of something designed in detail—a wind-tunnel test of a model is an example.

Applied research is devoted to obtaining new information in aid of a firm objective before detailed design work is done.

Pure research is the obtaining of new knowledge in a potentially useful field, but with only a rudimentary idea of the uses to which it will be put.

On Mr. Morgan's definition, industrial research is mainly *ad hoc*, while the universities do basically pure research and establishments such as the R.A.E. are in a middle position. This is only a generalization though; both industry and universities are increasingly concerned with applied research and Government establishments work on all three types.

For research and development work companies have built up extensive wind-tunnel, structural test and computing facilities; engine companies have expensive ramjet, rocket and turbojet test plants. But inevitably and logically the most expensive and advanced research equipment and facilities such as missile ranges and the largest wind-tunnels are under the control of research establishments.

Future developments in aeronautics leading to faster, higher-flying aircraft and satellites must depend to a large extent on the facilities of the establishments—private industry has not, as a rule, the shock-tubes, hypersonic tunnels, free-flight model test ranges and kinetic-heating test-plant needed. Industry will

Britain's largest and most expensive research facilities are owned by the Ministry of Supply. This is the 8-ft. supersonic tunnel at Bedford.

probably have to work in even closer collaboration with research establishments than it has done in the past.

The industry is perhaps over-equipped with facilities in relation to the current demand for conventional aircraft, while being short of those needed for the development of the most advanced missiles and supersonic aircraft. There is a chance that this state of affairs will accelerate the spread of advanced techniques to other industries. Ground-borne transport, for example, could benefit greatly from both the structural and aerodynamic knowledge of the aircraft industry.

The Official View

The prospects and the future of Britain's industry are receiving intensive Government study. A working party, often referred to as the Padmore Committee, is at present considering the future of the industry in the light of current defence policy.

A consequence of this committee's work was a statement of future Government policy on research and development made by the Minister of Supply in the House of Commons on May 13 last. He said that "The current reduction in defence demands, both in numbers and for certain types of manned aircraft, will inevitably entail some contraction in the present size of the British industry, but there will still be a need for an efficient and economic industry to meet the Services' requirements for aircraft and guided weapons. The Government will therefore continue, as necessary, to sponsor and finance aeronautical research and development to meet these defence requirements."

It was also stated that contributions would be made toward research for civil transport development, but it was expected that the industry would progressively assume responsibility for civil research. It was implied that such a contribution would depend on the industry reorganizing and strengthening itself to meet the new conditions which face it.

In replies to questions the Minister stated that the Government contribution to both civil and military research would continue "on about the present scale," the precise details of which he would not give. He said that civil and military research were "inextricably intertwined," and that as civil research became more and more identifiable, in course of time its cost would be passed on to the industry itself.

Answering Press questions the Minister said that he foresaw that the industry would contract over the next five years from its present level of about 250,000 people to 100,000. He suggested there was only room for perhaps two aero-engine units and three or four airframe units.

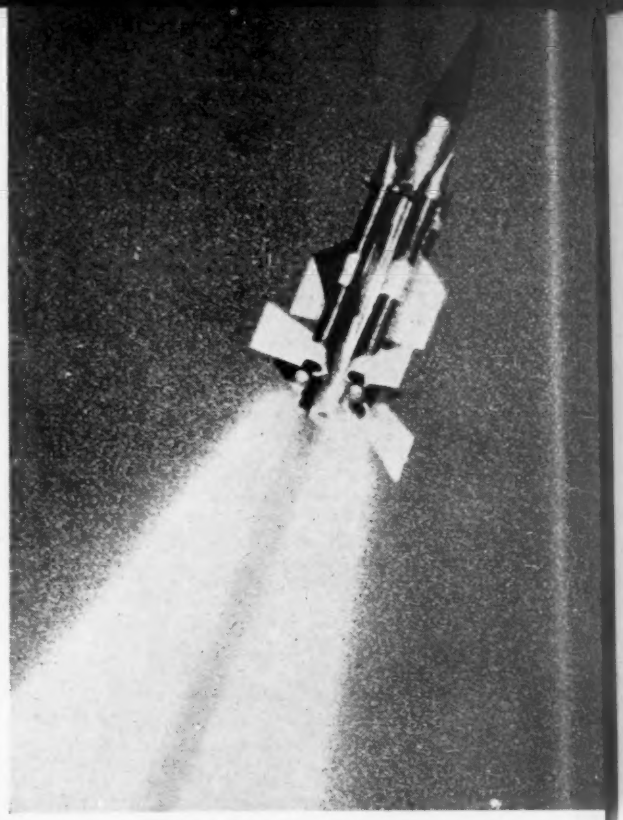
A statement of the basic Government policy was made by Lord Mancroft during a House of Lords debate on July 16. He said that the Government was underwriting the future for the industry by continuing the basic research necessary for it to survive, which included the construction of research aircraft. In the immediate future a partnership was envisaged between State and industry, with the one financing basic research and the other financing aircraft development and production.

Economic Aspect

British aircraft exports are now at a record level; they are based mainly on military and civil types designed and developed in the immediate post-War years under M.o.S. contracts. Such a flow of exports will not be easy to maintain; competition to obtain overseas orders for airliners is now very intense. The time must come when the present military aircraft we have for export will approach obsolescence by the standards of the major Powers, while aircraft which might be sold in future are just not being developed.

This state of affairs augurs ill for the future unless British missiles can be sold overseas. The post-War series of research and development contracts diminished after the Korean War and virtually came to an end with the 1957 Defence White Paper. Thus military sales in future must tend to fall away. New civil aircraft are being developed without M.o.S. backing; their export is essential if their manufacturers are to break even, but overseas deliveries are unlikely before the mid-1960s.

In surveying the prospects it is instructive to consider the U.S. position, as American competition is most to be feared in export markets.



British ground-to-air missiles are under constant development; the ultimate in this field will be the anti-missile missile for defence against ballistic attacks.

Military Prospects

Military research, development and production orders have always been the mainstay of the aircraft industry. For this reason the change in policy announced in the 1957 Defence White Paper was ominous.

This document introduced a new defence policy intended to relieve the strain on the economy caused by defence expenditure. Military research and development were to be restricted to projects which were absolutely essential.

It was recognized that Britain could not be adequately protected against nuclear-weapon attack; and thus that the overriding consideration should be to prevent war rather than to prepare for it. Protection was to depend on the nuclear deterrent. Nuclear weapons would be delivered by V-bombers and ballistic rockets.

The manned fighter force was to be reduced in size and used to defend bomber bases. Fighters would be equipped with

(*Continued on page* 295)

Expensive research and test facilities are essential for development of the latest powerplants. This new ramjet test-plant at Bristol Aero-Engines, Ltd., was opened last April.

(*Continued from page* 294)

air-to-air missiles, and in due course the fighters would be replaced by ground-to-air guided missiles. Work on fighters more advanced than the English Electric P.1 (now named the Lightning) would be ended.

Priority was to be given to the development of nuclear weapons for delivery by bombers and ballistic rockets. Nuclear warheads were to be developed for defensive missiles. Development of a supersonic bomber was to be ended as it was thought unlikely that it could enter service in much less than 10 years. This White Paper policy not unnaturally came as a blow to the aircraft industry.

The 1958 White Paper on defence gave more information about progress with the missile strategy. It announced that deliveries of H-bombs to the R.A.F. had begun and that a stand-off bomb for the V-bombers was being developed.

This White Paper was not so definite about Fighter Command's demise. It stated that the value of fighter defence would decrease when the Russians had enough ballistic rockets to knock out the airfields in Britain, but that this stage had not been reached. The document also said that deployment of short-range ground-to-air missiles would begin in 1958 and that a longer-range weapon was under development.

A significant point made in the White Paper was that expenditure on the strategic bomber force, its nuclear bombs and related research and development, including work on ballistic rockets, was less than a tenth of the defence estimate for 1958-59 (i.e., less than £142 million). The fighter force and control and warning system, with research and development on fighter and defensive guided missiles, represented a similar amount. Together they totalled between 15% and 20% of the total defence estimates. On present plans these costs were unlikely to increase significantly over the next few years.

Other points made were that Britain was to receive intermediate-range ballistic missiles from the U.S. and that a more advanced British ballistic missile was under development.

The only new manned aircraft mentioned in the White Paper was a low-level tactical bomber for the Navy, whose adoption, it was stated, was being considered by the R.A.F. This is the Blackburn NA.39.

The current missile policy has no doubt been adopted as a calculated risk, because it cannot be fully effective for many many months. Defence planners have been faced simultaneously with a reduction in the money available for defence spending and with great increases in the cost of manned aircraft. During the past 10 years the cost of a bomber has multiplied 15 times; fighter costs have gone up by more than 10 times.

Since the Defence White Paper of 1957 there have been many signs that the R.A.F. is unhappy about a policy which ties British defence to the guided missile. Its recent presentation of policy, on May 6, "Prospect 2" made this point.

Air Vice-Marshal W. H. Kyle, A.C.A.S. (O.R.), suggested that a second generation of manned and unmanned weapons would be needed to correspond with the V-bombers and IRBMs. These could take the form of a manned vehicle not tied to large and vulnerable airfields, but capable of delivering a weapon from outside an enemy's perimeter defences, and a ballistic missile which could be deployed and launched without the inflexible fixed ground organization now required.

For tactical attack a Canberra replacement was needed. It must combine very high performance with the ability to operate from restricted airfields. It should be able to act as a strike or reconnaissance aircraft in all weather conditions and should be capable of high speed at low level and be supersonic at altitude.

Fighters would still be needed to intercept stand-off bombers, for aerial policing and for attacking aircraft which attempted to jam defensive radar from outside the range of defensive missiles.

Other aircraft needed were a simple and versatile fighter for use in limited conflicts or police-action warfare and possibly a large long-range military freighter.

What research and development prospects, then, are there in the military field? For missile manufacturers the future seems bright. Development of a British long-range ballistic missile, the D.H. Blue Streak, is under way; it will have a range of 2,000-2,500 miles. In the air-to-air field there is the D.H. Firestreak. Ground-to-air weapons are represented by the Bristol Bloodhound and English Electric Thunderbird; a longer-range weapon, probably a development of the Bloodhound, is also in hand.

For the Navy there is the Armstrong Whitworth Seaslug. And as the ultimate in this field work is being done on a British anti-missile missile; this weapon was hinted at during a Press visit to the Royal Radar Establishment in April and since then it has been mentioned by the Minister of Supply.

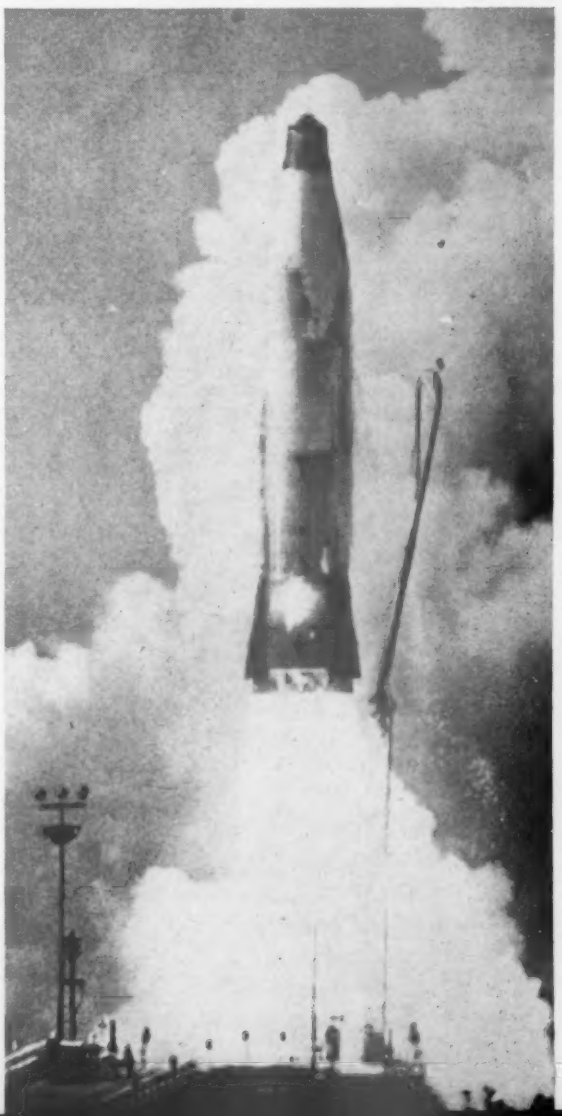
An air-to-ground missile, the Avro stand-off bomb, is under development; it was revealed at "Prospect 2" that a later version with a range of several hundred miles is to be built.

For the manufacturers of manned aircraft the outlook is not so bright. It does appear that in due course a development order for a Canberra replacement will be given; competition is intense. But as for the other types mentioned at "Prospect 2," official defence policy and shortage of money seem likely to conspire against them. Even the long-range heavy freighter, although obviously greatly needed, seems unlikely to be ordered for some while, despite the private-venture design work done on such an aircraft by Blackburn, Handley Page and Shorts. Helicopters, however, are in demand.

Clearly if military research and development expenditure is to remain at a constant level, the increasing cost of an extensive missile programme can be met only at the expense of manned aircraft. This must tend to hit hard at the companies which are geared to their design and development; many wind tunnels and research facilities may be rendered obsolete and out of work.

How does this position compare with that in the U.S.? One might expect that a country whose development of missiles was ahead of that in Britain might have relied on missile armaments. No such thing has happened, however, possibly because America's greater experience with missiles has shown that they are not the answer to every defence problem.

Although the U.S. is producing missiles in bewildering profusion, manned aircraft are still to be built. During 1958-59 U.S. spending on research, development and testing of military



Future aeronautical development is likely to concentrate on missiles and spacecraft. Britain is now building a ballistic missile, the de Havilland Blue Streak, with a range of 2,000-2,500 miles; further ahead in development is the Atlas, seen here, a U.S. missile designed for an intercontinental range.

aircraft and missiles is to total £2,210 million—of which £1,142 million will be devoted to missiles.

Manned military aircraft to be developed include a Mach-3 chemically fuelled bomber and long-range interceptor—the North American B-70 Valkyrie and the F-108. Also under development are the Dyna-Soar boost-glide rocket-bomber and a nuclear-powered bomber, which are longer-term projects. Thus in the strategic bomber field the U.S. plans for manned aircraft in the future; the supersonic Convair B-58 Hustler is likely to replace the B-47 and in due course the B-70 will take over from the B-52.

U.S. military orders range widely over fighters, trainers, transports and helicopters besides missiles, and thus the U.S. industry has reasonable research and development prospects, in addition to receiving military orders helpful for the sales of civil aircraft.

Economics are the key to America's ability to back both missiles and manned aircraft. Britain's defence estimate for all three Services totals less than £1,500 million annually; as stated earlier the U.S. is now spending £2,210 million a year on research, development and testing of aircraft and missiles alone.

Civil Prospects

Civil aircraft development in Britain is to be financed by the industry in future, according to government decisions, although some research aid will be given and possibly some financial backing will be provided in due course for supersonic-airliner development.

This policy has been applied to development of the new D.H.121 and Vickers V.C.10 jet airliners for B.E.A. and B.O.A.C. It has not led to any amalgamations in the industry, however, and in fact a new concern, the Aircraft Manufacturing Co., Ltd., has been formed so that three existing companies can share in the financial backing and development of the D.H.121.

This new policy is unpopular. Orders given for the Corporations are not enough for the companies to break even and they must gamble on receiving additional orders if they are to get their money back, much less make a profit.

Recent statements in the House of Lords by the chairmen of Rolls-Royce and Vickers, two of the most successful companies, make this point. Lord Knollys, Vickers chairman, said it was financing two projects from its own funds. Unless limited aid became available "these may be the last we can undertake entirely from our own resources unless and until they have reasonably paid off and the capital released to make other projects."

Rolls-Royce's chairman, Lord Kindersley, pointed out the cost of aero-engine research and development and said that "there are limits to the number of types of aero-engines which the industry can develop off its own bat at £20 million a time."

But while a new generation of jet airliners is under development in Britain, the next step, a supersonic airliner, hangs fire. It is recognized that development of such an aircraft involves immense and perforce collaborative effort. Leading companies have been studying the problems, in conjunction with the R.A.E., since January last year; there is no doubt that a supersonic airliner can be built, but its operating economics are the stumbling block. On May 22 it was reported in the House of Commons that an answer to the joint study was expected in 12 to 18 months' time. If development of a supersonic airliner was favoured, a suitably powerful manufacturing group would have to produce a practical design and Government assistance would be brought into play.

On this basis the exciting prospect of a British supersonic airliner seems to be very far ahead. Meanwhile, in the U.S. a great deal of work is under way on supersonic transports and this is greatly helped by experience with supersonic military aircraft. Boeing, Convair, Douglas and Lockheed are all known to be working in this field and provisional U.S.A.F. requirements for a supersonic tanker have been issued. Thus the U.S. is at this time better placed than Britain to build a supersonic transport.

Research Projects

Research contracts for the aircraft industry are few at present. It is unfortunate that at a time when the field for investigation is wider than ever before this country should perforce have to be highly selective.

For high-speed research we have two existing aircraft, the Fairey F.D.2 and Saunders-Roe S.-R.53, while a third, an all-steel supersonic research aircraft by Bristol, is said to be under development. Another project, but one which no longer has M.o.S. backing, is the variable-sweep Vickers Swallow.

A great military future, and possibly a civil one too, is seen for VTOL aircraft. M.o.S.-backed in this field are the Fairey Rotodyne and the Short S.C.1, which has vertical-thrust jet engines. There is also a rumour of work on ducted-fan lift by Boulton Paul.

In the missile field there are indubitably research projects yet concealed, some probably directed towards space. Mention has been made of the Black Knight, a re-entry research vehicle for the Blue Streak IRBM. Only recently the Minister of Supply revealed that either the Black Knight or the Blue Streak might be used to launch a British satellite. Other work is being done to produce an anti-missile missile.

Another project leading towards space has been mentioned by an Avro representative; it is a rocket-powered vehicle for high-altitude research which would be air-launched from a Vulcan. The missile companies and research establishments may well have several such projects competing for official approval and financial backing.

Many other fields of research are likely to compete for funds. For example, laminar-flow studies of the type made by Handley Page could bring immense benefit to subsonic air travel. The task of those who decide which research projects should have financial backing must be an unenviable one.

Conclusion

Research and development prospects for Britain's aircraft industry are limited by economics—money is short. Future trends indicate that existing research facilities may be outdated by technical advances. As a result the official research establishments will probably have to play an even greater rôle than they have in the past.

In the civil field very slow progress is apparent with a British supersonic transport. There is a widely supported view that the great expenditure involved in such an aircraft might well be better spent on projects which had a wider potential export market. However, the better is always the enemy of the good and if one industry can offer supersonic aircraft to its customers, other industries competing with it will have to do likewise.

VTOL studies have important implications for future military and civil aircraft. The Short S.C.1 research aircraft should yield very useful information on jet-lift VTOL and the problems of transition to and from forward flight. It has begun hovering tests in this gantry.

British Aircraft and Aero Engines

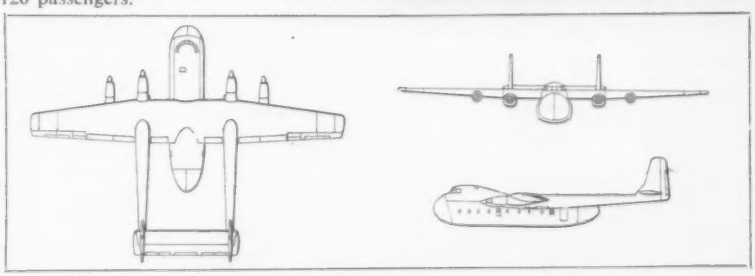
In the 32 pages of this special supplement, we give details of the latest aircraft, aero-engines and guided weapons now in production or undergoing development by Britain's aircraft industry. To make this review as comprehensive as possible, however, some of the older aircraft and engines have been omitted to make room for later projects. A standard form of presentation has been adopted, but because of security in some cases, it has not been possible to give the technical data and illustrations in the same form throughout.

Armstrong Whitworth Argosy

Powerplant
Four 2,100-e.h.p. Rolls-Royce R.Da.7/2 Dart 526.
Accommodation
71–83 passengers (up to 126 in A.W.670).
Dimensions
Span: 115 ft.
Length: 86 ft. 9 in.
Height: 27 ft.
Wing area: 1,458 sq. ft.
Weights and Loadings
Basic operational: 46,000 lb.
Total fuel: 26,400 lb.
Mfrs. max. payload: 28,000 lb.
Max. take-off: 82,000 lb.
Max. landing: 78,000 lb.
Max. zero fuel: 74,000 lb.
Performance
Recommended cont. cruising speed (I.S.A.): 263 knots (at 20,000 ft. and 70,000 lb.); consumption: 360 Imp. gal./hr.; power: 14,000 r.p.m.
Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 4,080 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 2,940 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (3,300 Imp. gal.): 3,480 n.m. with 9,400 lb. payload at 244 knots (mean) at 23,000 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 620 n.m.

SCHEDULED to fly by the end of the year, the A.W. 650 Argosy has been designed specifically as a civil freighter and air-coach transport.

Three variants are planned. The 650 Argosy is the medium-range all-passenger version with up to 83 seats; the A.W. 670 is a short-range vehicle carrier accommodating six cars and 30 passengers in a wider fuselage and known as the Air Ferry, and the A.W. 671 is an all-passenger version of the 670 known as the Airbus with up to 126 passengers.



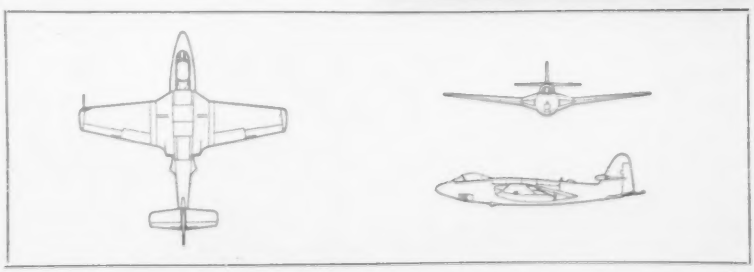
Armstrong Whitworth Sea Hawk

SEA HAWK 100/101

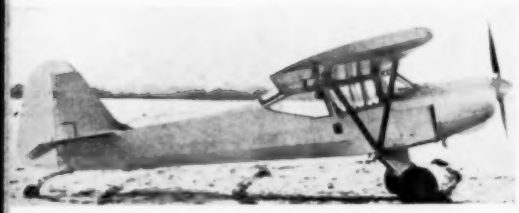
Powerplant
One 5,400-lb. Rolls-Royce Nene 103 (R.N.6).
Crew
Pilot.
Armament
Four 20-mm. Hispano cannon with 150 rounds per gun; underwing bombs, rockets or other stores.
Dimensions
Span, 39 ft.
Length, 40 ft. 3½ in.
Height, 9 ft. 9½ in.
Wing area, not available.
Weights
Not available for publication.
Performance
Max. speed, 530 m.p.h. at sea level. Cruising speed, initial climb, and service ceiling not available for publication.
Range (internal fuel), 920–580 miles.

SIX versions of the Sea Hawk were delivered by Armstrong Whitworth to the Royal Navy, comprising the F1, F2, FB.3, F(GA.)4, FB5 and F(GA.)6, and production is now concentrated on orders from NATO countries.

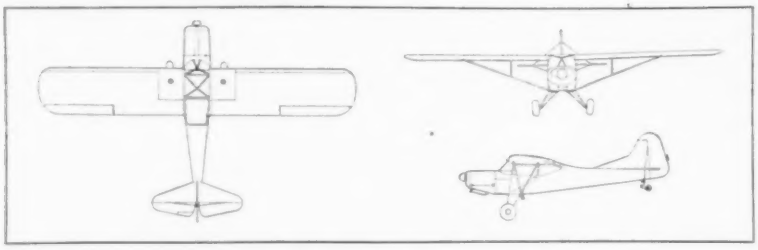
Twenty-two Sea Hawk Mk. 50s have been ordered by the Royal Netherlands Navy. The German Kriegsmarine is equipping with 34 each of the Mk. 100 and Mk. 101, with additional electronic equipment and a taller fin and rudder.



Auster J1U Workmaster



DESIGNED to the requirements of Crop Culture, Ltd., who wanted an aeroplane to carry 100 gal. of insecticide; carry a passenger besides the pilot, and to have a better agricultural capacity than other similar types, along with some other specialized features, the Workmaster first flew on February 22, 1958. It can carry a 780-lb. payload.



Powerplant
180-b.h.p. Lycoming O-360-A flat-four air-cooled engine.

Crew
Pilot and passenger.

Dimensions
Span: 36 ft.
Length: 23 ft. 7 in.
Wing area: 184 sq. ft.

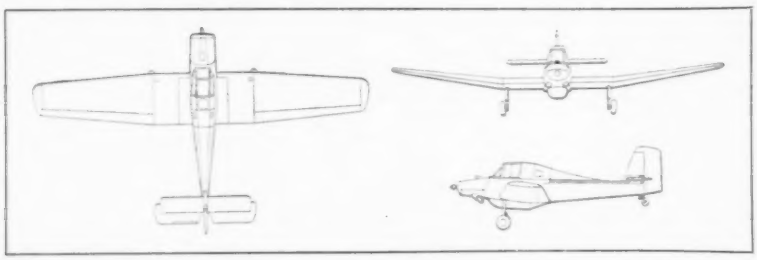
Weights
Max. loaded: 2,650 lb.
Empty: 1,565 lb.

Performance
Max. cruising: 100 m.p.h.
Econ. cruising speed: 93 m.p.h.
Initial climb: 570 ft./min.
Service ceiling: 9,500 ft.
Take-off to 50 ft.: 560 yd.
Range: 320 miles.

Auster B8 Agricola

GOOD slow-flying characteristics were features specially considered in the design of the Agricola, which has been built for crop-dusting and spraying and fertilizer-spreading duties.

A hopper, with a capacity of ¾-ton, is installed behind the pilot for dry loads, and spray bars are fitted under each wing. The maximum payload is 1,510 lb. Forty gallons of fuel can be carried.



Powerplant
240-b.h.p. Continental O-470-M2 flat-six air-cooled engine.

Crew
Pilot.

Dimensions
Span: 42 ft.
Length: 28 ft. 1 in.
Height: 8 ft. 4 in.
Wing area: 254 sq. ft.

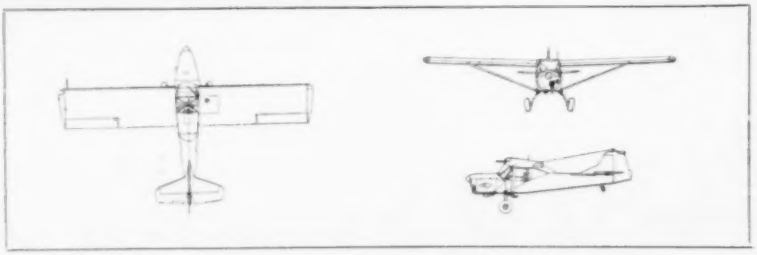
Weights
Max. loaded: 3,900 lb.
Empty: 2,025 lb.

Performance
Max. cruising: 126 m.p.h.
Econ. cruising speed: 100 m.p.h.
Initial climb: 540 ft./min.
Service ceiling: 9,400 ft.
Take-off to 50 ft.: 650 yd.
Range: 200 miles.

Auster AOP.9

SINCE the beginning of 1955, when the first Mk. 9 air observation post was delivered, the type has been increasingly used for military purposes, being exported to South Africa and India besides serving with the Army.

For AOP duties the Mk. 9 is equipped as a two-seater, the observer placed in the rear of the cabin and facing backwards. A second passenger seat can be fitted alongside the pilot.



Powerplant
180-b.h.p. Blackburn Cirrus Bombardier 203 four-cylinder in-line air-cooled engine.

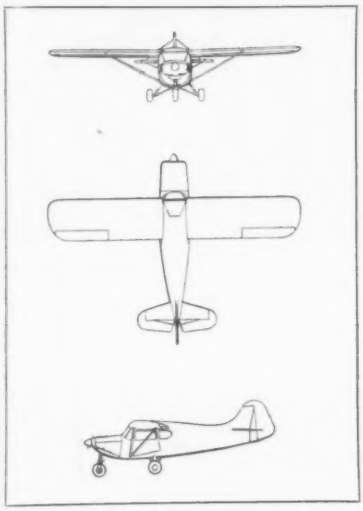
Crew
2-3.

Dimensions
Span: 36 ft. 3 in.
Length: 23 ft. 8½ in.
Height: 8 ft. 11 in.
Wing area: 197.6 sq. ft.

Weights
Operational: 2,125 lb.
Empty: 1,543 lb.

Performance
Max. speed: 127 m.p.h.
Cruising speed: 110 m.p.h. at 1,000 ft.
Initial climb: 920 ft./min.
Service ceiling: 18,000 ft.
Take-off to 50 ft.: 225 yd.
Range: 240 miles at 110 m.p.h

Auster Atlantic



FOLLOWING customary Auster construction in having a welded steel-tubular framework with fabric covering, the Atlantic four-seat touring monoplane nevertheless differs from earlier products of the company in having a nose-wheel landing gear and a new characteristic profile.

In this aircraft special attention is being paid to soundproofing and, by limiting the extent of the Perspex roof, it should be comfortable to operate in the tropics. The air-conditioned cabin seats four in two pairs, and there is a wide access door on each side. Smoking will be permitted.

A Hartzell variable-pitch two-blade propeller is fitted, and there is provision for 40 gal. of fuel.

Each of the three Lockheed undercarriage legs carries a similar-sized and interchangeable wheel.

It is expected that fuel consumption will be about 11 g.p.h.

The photograph above shows a mock-up of the Atlantic as it appeared at the 1957 S.B.A.C. Exhibition.

Powerplant
185/205-b.h.p. Continental E-185-10 flat-six air-cooled engine.

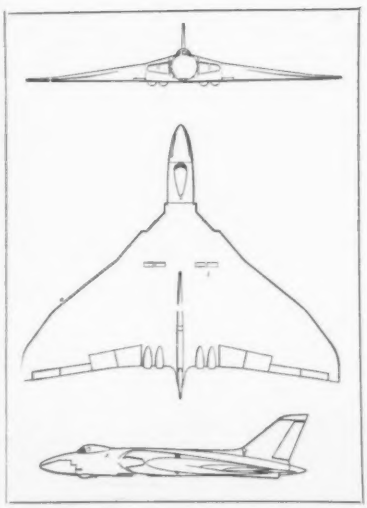
Crew
Pilot and three passengers.

Dimensions
Span: 36 ft.
Length: 23 ft. 10 in.
Height: —
Wing area: 184 sq. ft.

Weights
Max. loaded: 2,700 lb.
Empty: —

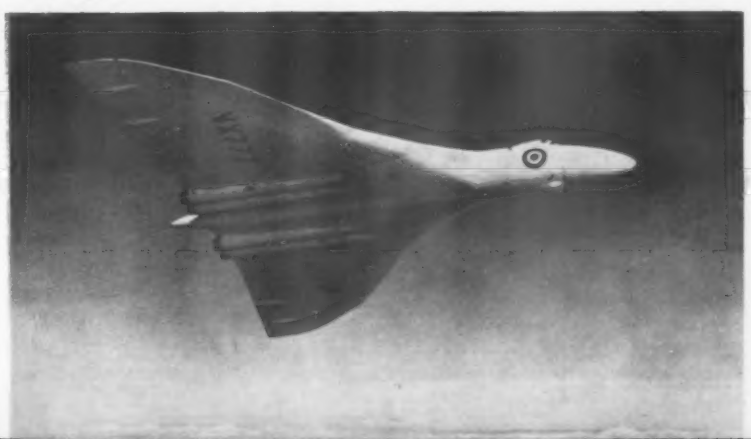
Performance
Max. cruising: 135 m.p.h.
Cruising speed: 110 m.p.h.
Stalling speed 55 m.p.h.
Initial climb: 740 ft./min.
Service ceiling: 13,000 ft.
Take-off to 50 ft.: 410 yd.
Range: 500 miles.

Avro Vulcan



THREE units—Nos. 83, 101 and 617 Squadrons—are now operating the Avro Vulcan B.1 in R.A.F. Bomber Command, and more squadrons are to be formed later this year with the bigger and more powerful Vulcan 2. The Vulcan 1 started its service life with 11,000-lb. Olympus 101 turbojets, but later production aircraft have the 13,000-lb. Olympus 104s. The Vulcan 2, however, which has an extensively revised wing, is powered by the 200 Series Olympus of about 16,000 lb. s.t.

As will be seen from the equivalent dimensions (Vulcan 1 in parentheses), the Vulcan 2 has a much greater span, while its gross weight has been increased and its wing is of a reduced thickness-chord ratio. Less apparent modifications are the replacement of the former separate aileron and elevator surfaces on the wing trailing edges by elevons and the incorporation of conical camber on the cranked leading edges. A Vulcan B.1 is being used in the development of the Avro stand-off bomb or air-to-surface missile.



Powerplant
Four 16,000-lb. s.t. Bristol Olympus B.Ol.6 (200 Series).

Crew
Pilot, co-pilot, nav./plotter, nav./radar, A.E.O.

Armament
Thermonuclear, atomic or explosive bombs, and air-to-surface missiles.

Dimensions
Span: 111 ft. 0 in. (99 ft.).
Length: 97 ft. 1 in. (97 ft. 1 in.).
Height: 27 ft. 6 in. (26 ft. 6 in.).
Wing area: Not available.

Weights
Not released for publication.

Performance
Not released for publication.

Avro Shackleton

SHACKLETON MR.3

Powerplant
Four 2,450-h.p. Rolls-Royce Griffon 67.

Crew
10.

Armament
Two 20-mm. nose cannon, fuselage bombs, depth charges, homing torpedoes, and other stores.

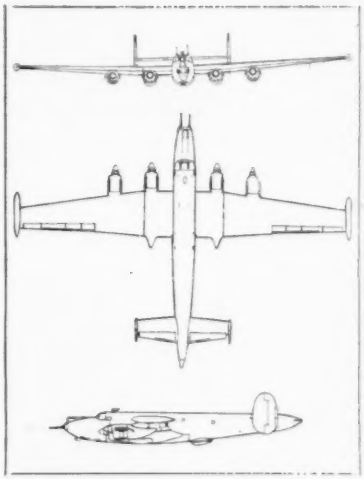
Dimensions
Span: 120 ft. 6½ in.
Length: 87 ft. 4 in.
Height: 23 ft. 4 in.
Wing area: Not released for publication.

Weights
Not released for publication.

Performance
Not released for publication.

ALTHOUGH primarily produced for maritime reconnaissance duties, the Shackleton has shown remarkable versatility in trooping and close-support operations with the R.A.F., and in its latest form, the MR.3, is being supplied for similarly general duties to the South African Air Force. Seventy-seven Shackleton MR.1s and 1As were built for R.A.F. Coastal Command, which also received a quantity of MR.2s incorporating numerous improvements.

Delivery to the R.A.F. of the Shackleton MR.3, with a nosewheel undercarriage, wing-tip tanks and other modifications, began early in 1958, No. 220 Squadron being the first unit to re-equip. The S.A.A.F. received its first Shackleton 3 slightly ahead of the R.A.F., and all eight of its aircraft are now in service with No. 2 Maritime Group. One further service version of the Shackleton is the T.Mk.4, which is a converted Mk.1 for use as a navigational trainer.



Blackburn Beverley

BEVERLEY C.1

Powerplant
Four 2,850-h.p. Bristol Centaurus 173.

Crew
Two pilots, radio operator and navigator.

Accommodation
Main freight compartment 40×10×10 ft. Tail compartment 14×6×8.5 ft. Max. load, 94 troops or 22,000 lb. of freight.

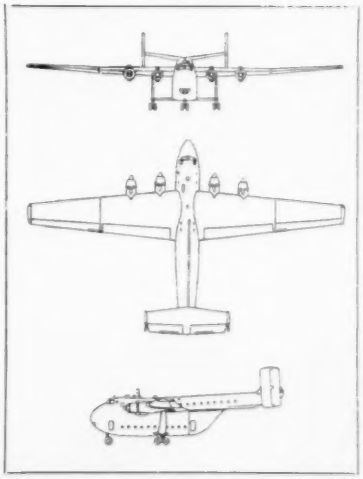
Dimensions
Span: 162 ft.
Length: 99 ft. 5 in.
Height: 38 ft. 9 in.
Wing area: 2,916 sq. ft.

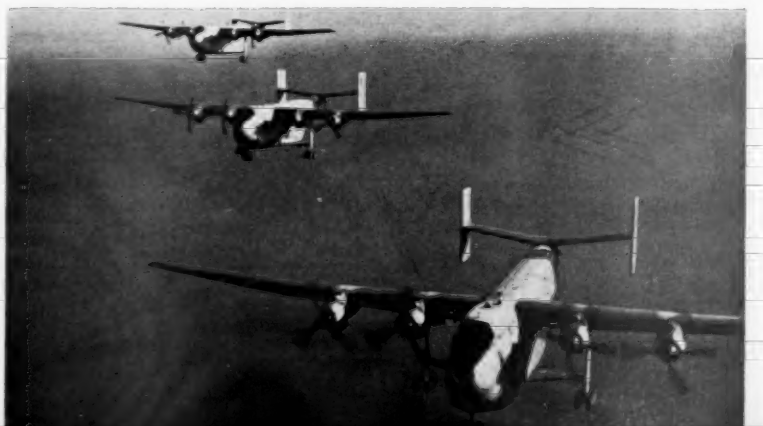
Weights
Basic: 82,100 lb.
Max. gross: 135,000 lb.

Performance
Max. speed: 246 m.p.h. at 5,700 ft.
Cruising speed: 175 m.p.h. at 12,500 ft.
Initial climb: 760 ft./min.
Service ceiling: 16,000 ft.
Take-off to 50 ft.: 1,340 ft.
Range (typical operating): 1,861 miles with 26,460-lb. payload.

WITH the Shackleton, the Beverley is one of the few piston-engined aircraft types to be delivered to the R.A.F. in recent years. The initial order for 47 Beverleys has been completed, and these aircraft now equip three squadrons in R.A.F. Transport Command, plus another in Middle East Air Force. With a maximum short-range payload of 44,000 lb., plus rear-loading facilities, the Beverley offers exceptional tactical mobility for heavy equipment and troops to the Army, and is one of the major instruments for the deployment of the U.K. Strategic Reserve.

After removal of the rear clam shell doors, the Beverley may be used for dropping all types of military loads by parachute, and in development tests, weights of up to 14 tons have been successfully released in flight with the support of clustered canopies. Paratroops may also be dropped from the passenger compartment in the tail boom.





Blackburn NA.39

Powerplant
Two de Havilland Gyron Junior turbojet engines.

Crew
Two.

Armament
No details available.

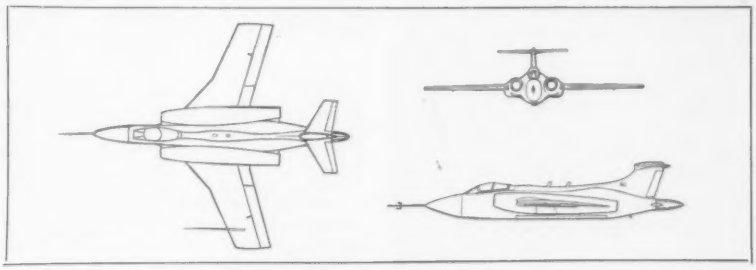
Dimensions
No details available.

Weights
No details available.

Performance
Cruising speed: Subsonic.
Radius of action: Reported to be 700 miles.

DESIGNED primarily as a carrier-borne strike aircraft for low-level "under-the-radar" attacks with nuclear weapons, the Blackburn NA.39 made its first flight on April 30 this year. Twenty development NA.39s are being built. Production orders are being sought from the Royal Navy, the R.A.F. and the United States.

Interesting technical features of the NA.39 are its area-ruled fuselage and blown flaps.



Bristol 192

Powerplant
Two 1,650-s.h.p. Napier Gazelle Series 2 free-turbine engines.

Accommodation
Two crew on flight deck. Accommodation for up to 18 passengers in communications version.

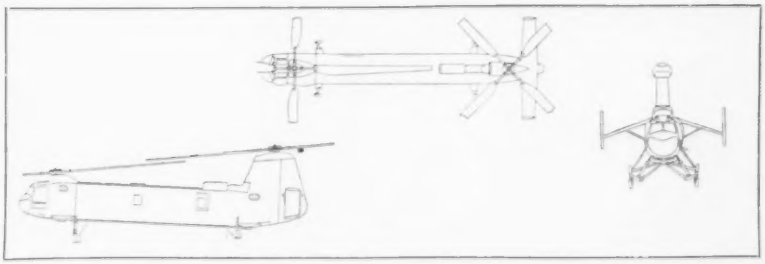
Dimensions
Rotor dia.: 48 ft. 8 in.
Length: 89 ft. 9 in.
Height: 17 ft.
Disc area: 1,860 sq. ft. (each rotor).

Weights
Normal take-off: 18,000 lb.
Empty (operational): 10,401 lb.
Disc loading: 4.84 lb./sq. ft.

Performance
Cruising speed: 100 knots at 2,000 ft.
Inclined climb: 1,180 ft./min.
Absolute ceiling: 8,000 ft. (hovering).
Normal range: 395 n.m. with 2,600 lb. payload, still air, no fuel reserves.

HAVING made its first flight in July, the Bristol Type 192 twin-rotor helicopter becomes Britain's second Gazelle-powered rotary-wing craft. It has been designed to meet Service requirements for such duties as supply dropping, search and rescue, trooping and freight carrying, paratrooping, and as an air ambulance.

The two free-turbine powerplants are installed at each end of the main cabin and are interconnected by a coupling shaft.



Bristol Sycamore

Powerplant
One 520-b.h.p. Alvis Leonides 524/1 radial.

Accommodation
Pilot and four passengers.

Dimensions
Rotor dia.: 48 ft. 7 in.
Length: 46 ft. 2 in.*
Height: 14 ft. 7 in.
Disc area: 1,856 sq. ft.

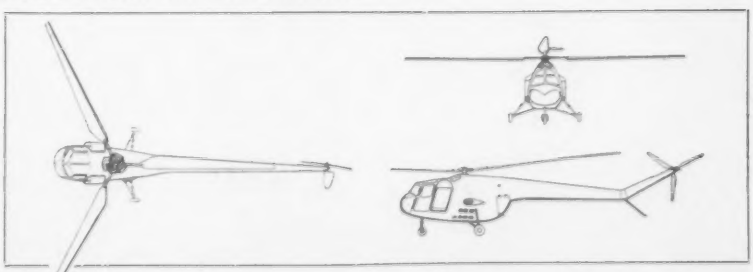
Weights
Normal take-off: 5,600 lb.
Empty: 3,965 lb.
Disc loading: 2.9 lb./sq. ft.

Performance
Cruising speed: 105 m.p.h.
Inclined climb: 1,300 ft./min.
Service ceiling: 14,500 ft.
Normal range: 288 miles.

* Blades folded.

A FIVE-SEATER in its civil form the Bristol Sycamore is in production at the company's helicopter factory at Weston-super-Mare and is in civil and Service use in many parts of the World.

More than 150 Sycamores have been built to date. One of the more recent orders has been from the West German Government which in March of last year ordered 50 for use by the German Army, Navy and Air Force as search and rescue craft, for ambulance duties, and as light transport and communications machines. Of this number to date about three dozen have been delivered.

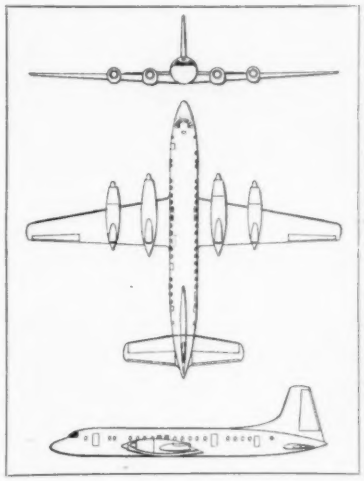


Bristol Britannia 310

Powerplant
Four 4,237-e.h.p. Bristol Proteus 765 turboprops.
Accommodation
99–133 passengers.
Dimensions
Span: 142 ft. 3.5 in.
Length: 124 ft. 3 in.
Height: 37 ft. 4.5 in.
Gross wing area: 2,075 sq. ft.
Weights and Loadings
Basic operational: 92,040 lb.
Total fuel: 68,376 lb.
Mfrs. max. payload: 28,000 lb.
Max. take-off: 180,000 lb.
Max. landing: 135,000 lb.
Max. zero fuel: 122,000 lb.
Wing loading (max. t-o. wt.): 86.8 lb./sq. ft.
Power loading (max. t-o. wt.): 10.6 lb./e.h.p.
Performance
Typical high cont. cruising speed (I.S.A.): 345 knots (at 22,000 ft. and 140,000 lb.); consumption: 700 Imp. gal./hr.; power (per engine): max. continuous.
Balanced field length (at max. t-o. wt.): At I.S.A. at sea level: 7,200 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 3,500 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (8,547 Imp. gal.): 4,790 n.m. with 19,584 lb. payload at 310 knots (mean) at 29,000 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 4,060 n.m.

DEVELOPED from the original Britannia 100, the Britannia 310 has an extended fuselage (by 10 ft. 3 in.), increased tankage and more powerful Proteus engines. Two versions of the basic 300 Series are in service, one with the original tankage for medium-stage-length operation and one with a "long-range" wing increasing the fuel capacity by 1,890 Imp. gal. The developed long-range 310 is now known as the 320 with Proteus 765 engines each giving 260 s.h.p. more for take-off, a lower specific fuel consumption and a slightly higher cruising power.

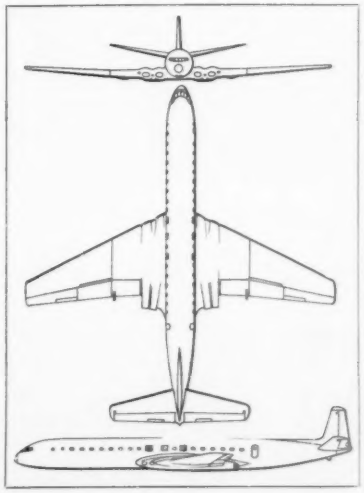
Variants of the Britannia are available for cargo or mixed loads. These, the Series 250, have been ordered by the M.o.S. (as the 252) for the passenger-cargo transport and for R.A.F. Transport Command (the 253) for all-cargo operation and troop carrying. Other customers are B.O.A.C. (33), El Al (4), Aeronaves (2), C.P.A.L. (6), Cubana (2) and Hunting-Clan (2).



De Havilland Comet 4

Powerplant
Four 10,500-lb. s.t. Rolls-Royce Avon 524 (R.A.29) turbojets.
Accommodation
60–90 passengers.
Dimensions
Span: 114 ft. 9 in.
Length: 111 ft. 6 in.
Height: 28 ft. 6 in.
Gross wing area: 2,121 sq. ft.
Weights and Loadings
Basic operational: 74,100 lb.
Total fuel: 71,920 lb.
Mfrs. max. payload: 20,980 lb.
Max. take-off: 156,000 lb.
Max. landing: 114,080 lb.
Max. zero fuel: 95,080 lb.
Wing loading (max. t-o. wt.): 73.4 lb./sq. ft.
Power loading (max. t-o. wt.): 7.09 lb./lb. s.t.
Performance
Recommended cont. cruising speed (I.S.A.): 448 knots (at 28,500 ft. and 135,000 lb.); consumption: 1,140 Imp. gal./hr.
Balanced field length (at max. t-o. wt.): At I.S.A. at sea level: 6,700 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 3,560 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (8,990 Imp. gal.): 4,130 n.m. with 10,000 lb. payload at M=0.78 (mean) at 37,000 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A., with max payload, 3,240 n.m.

IN production at Hatfield and Chester, the de Havilland Comet 4 has behind it a long history of refinement and development. Three versions are available to suit particular airline needs. For long-haul work over stage distances of up to 3,000 miles the Intercontinental version carries 60-90 passengers. For short-stage operation over 300-1,500 miles there is the long-fuselage Comet 4B Continental, which has a reduced wing span and is intended for comparatively low-level cruising; it can accommodate up to 104 passengers. A version with the greater fuselage capacity of the 4B and the full-span wing of the Comet 4 is available as the Comet 4C Intermediate. British Overseas Airways Corporation has 19 Comet 4s on order; British European Airways, 6 Comet 4Bs; and Aerolineas Argentinas, six Comet 4s. The B.O.A.C. Mk. 4s are scheduled for introduction on the North Atlantic route on December 1.



De Havilland Sea Vixen

SEA VIXEN FAW.1

Powerplant
Two 10,000-lb. s.t. Rolls-Royce Avon 200 series.

Crew
Pilot and navigator/radar operator.

Armament
Four de Havilland Firestreak AAMs, or four 500-lb. bombs, or two Firestreaks and two 500-lb. bombs, or combinations of AAMs, bombs and rockets.

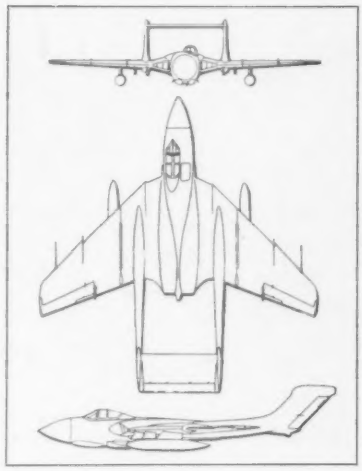
Dimensions
Span: 50 ft.
Length: 53 ft. 6½ in. (folded, 50 ft. 2½ in.).
Height: 11 ft.
Wing area: Not released for publication.

Weights
Not released for publication.

Performance
Not released for publication.

AFTER a prolonged development period, the Sea Vixen FAW.1 is now entering service with the Fleet Air Arm as a replacement for the Sea Venom all-weather fighter. The first Sea Vixen unit, No. 700 "Y" Flight, was set up in the summer of 1958 at Yeovilton to conduct intensive flying and working-up trials, before the formation of a fully operational squadron.

The Sea Vixen has the distinction of being the first British aircraft to enter operational service having a primary armament of guided missiles and dispensing with conventional cannon, and it is also the first transonic interceptor fighter to equip the Fleet Air Arm. Deck trials with the Sea Vixen were successfully completed as long ago as April, 1956, and one of the prototype aircraft has also undertaken a flight refuelling test programme. The crew are housed in pressurized and air conditioned cockpits, the navigator being totally enclosed in the nacelle.



De Havilland Vampire Trainer

DE HAVILLAND VAMPIRE T.11

Powerplant
One 3,500-lb. s.t. de Havilland Goblin 35.

Crew
Instructor and pupil.

Armament
Two or four 20-mm. Hispano Mk. 5 cannon with 300 rounds, and up to 2,000 lb. of underwing bombs, rockets or other stores.

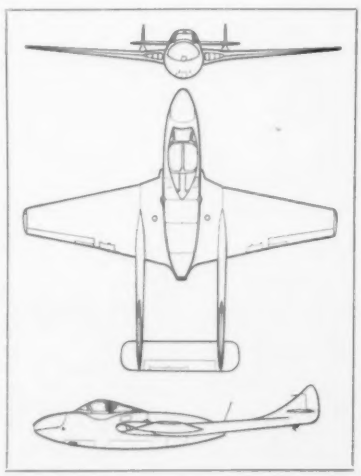
Dimensions
Span: 38 ft.
Length: 34 ft. 6 in.
Height: 8 ft. 2 in.
Wing area: 261 sq. ft.

Weights
Mean: 9,900 lb.
Normal take-off: 11,130 lb.
Max. gross: 12,920 lb.

Performance (at 11,150 lb.)
Max. speed: 477 knots at 30,000 ft.
Mean speed: 335 knots at 40,000 ft.
Initial climb: 4,500 ft./min.
Service ceiling: 40,000 ft.
Take-off to 50 ft.: 910 yd.
Range: 740 n.m. at 40,000 ft.

ONE of the most widely used advanced jet trainers yet produced, the D.H. Vampire T.11 is in service with the air forces of more than 20 countries, in addition to the R.A.F. and Royal Navy. In the last-named service it is known as the Sea Vampire T.22, while its export designation is the T.Mk.55. The Vampire Trainer is also produced in Australia for the R.A.A.F. and R.A.N. as the T.Mk.33 and T.Mk.35.

In its latest production form, the Vampire Trainer includes two Martin-Baker automatic ejection seats among its equipment, which also extends to a wide variety of armament for either instructional or operational application. The Vampire Trainer can therefore take its place in front-line squadrons of the smaller air forces in addition to being used for jet conversion, instrument and armament training. In the R.A.F., it is used to qualify students to "wings" standard, after 120 hr. on the Provost.



De Havilland 121

BRITISH EUROPEAN AIRWAYS has announced its intention of purchasing 24 D.H.121 triple-turbo-jet transports for service from 1964 onwards. Powered by three Rolls-Royce R.B.141 by-pass turbojets of about 12,000-lb.s.t. each, the D.H.121 will have a gross weight in the region of 120,000 lb. Development of this aircraft is being promoted by the Aircraft Manufacturing Co., formed for the purpose by the de Havilland, Hunting and Fairey companies.

No weights, dimensions or performance figures have been issued. Those in the original B.E.A. outline specification are given on the right. The manufacturers have suggested that the Corporation's requirements for a 1,000-mile stage will not prejudice the development of the basic design to suit longer stages. Emphasis is placed on a good runway performance (a length of 6,000 ft. has been quoted) and on the achievement of a high degree of economy.

Powerplant
Three 12,000-lb.s.t. Rolls-Royce R.B.141 turbojets.

Accommodation
70–80 passengers in standard-class seating or 95–100 passengers in high-density seating.

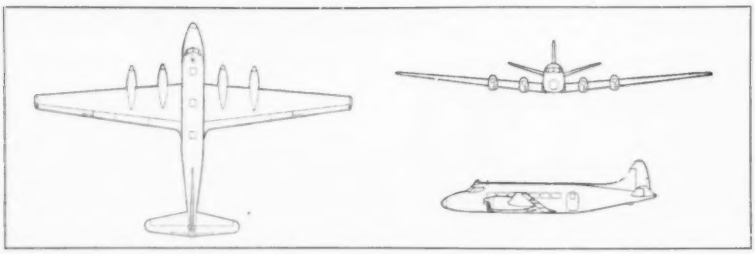
Dimensions
Not released for publication.

Weights
Not released for publication.

Performance
Cruising speed: 600 m.p.h. for stage distances of about 1,000 miles.

De Havilland Heron

IN the eight years since the de Havilland Heron first flew, some 130 of these four-engined transports have been produced, including three for The Queen's Flight. Providing accommodation for up to 17 passengers, the Heron can be supplied in several variants with fixed or retractable undercarriage, fixed or variable-pitch airscrews and a variety of interiors for airline, executive or specialized military rôles.



Powerplant
Four 250-b.h.p. D.H. Gipsy Queen 30 Mk. 2 six-cylinder in-line engines.

Crew
Two.

Accommodation
14–17 passengers with 127 cu. ft. of additional freight hold volume.

Dimensions
Span: 71 ft. 6 in.
Length: 48 ft. 6 in.
Height: 15 ft. 7 in.
Wing area: 499 sq. ft.

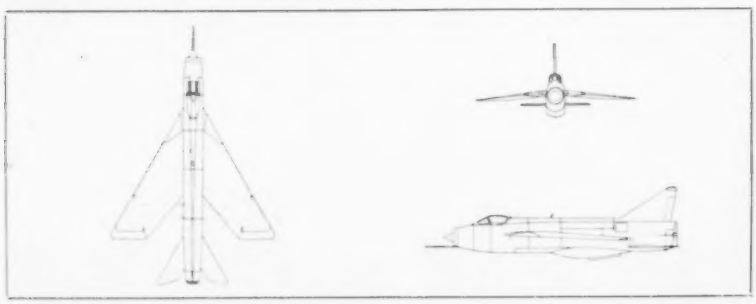
Weights
Max. take-off: 13,500 lb.
Max. landing: 13,150 lb.
Max. payload: 3,750 lb.
Basic operational: 8,996 lb.

Performance
Cruising speed: 159 knots at 8,000 ft.
Balanced field length: 3,570 ft.
Range: 1,540 n.m. with 1,320-lb. payload; or 500 n.m. with 3,750 lb. payload.

English Electric P.1B

FOLLOWING the construction of two research P.1As, three prototype and 20 pre-production P.1Bs were ordered for intensive development, and further production aircraft are due from 1959 onwards.

With its tremendous reheat power, the P.1B is supersonic in level flight at all altitudes, and with a rocket pack beneath the rear fuselage should have an unprecedented combat ceiling.



Powerplant
Two 11,250-lb. Rolls-Royce Avon R.A.24 with afterburning.

Crew
Pilot.

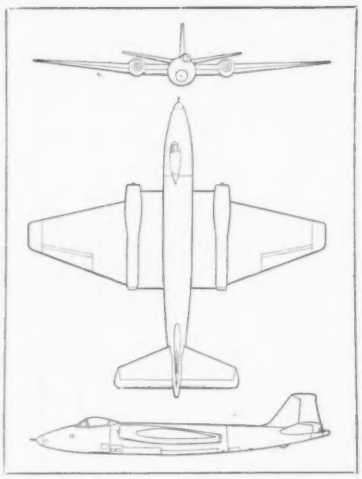
Armament
Four 30 mm. ADEN cannon, or two 30 mm. ADEN guns and two de Havilland Firestreak guided AAMs. Ferranti A.I. radar.

Dimensions
Span: 34 ft. 10 in.
Length: 50 ft.
Height: 19 ft. 7 in.
Wing area: Not released for publication.

Weights
Not released for publication.

Performance
Max. speed: Mach 2+.

English Electric Canberra



CANBERRA B.2s and B.6s equip a substantial number of R.A.F. bomber squadrons, while PR.3s and 7s are standard equipment for medium-range photographic - reconnaissance squadrons. With the later B(I).8s, and dual-control T.4 trainers, several of these Canberra variants are also in service with various foreign air forces, including those of Ecuador, France, India, New Zealand, Peru and Venezuela, in addition to their construction in Australia and the U.S.; and those in the R.A.F. will soon be joined by the PR.9.

Originally developed for photographic-reconnaissance at extreme altitudes, for which its extended wing was primarily designed, the PR.9 is also capable of undertaking the low-level recce. rôle, which is becoming increasingly important. The prototype PR.9 (photograph) has the Canberra bomber cockpit, but production aircraft will have B(I).8 " intruder " type noses.

CANBERRA PR. MK. 7

Powerplant
Two 10,000-lb. s.t. Rolls-Royce Avon 206.

Crew
Pilot and navigator.

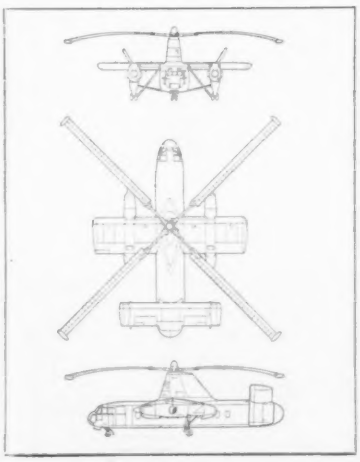
Armament
Equipped with numerous cameras, but provision for most normal light-bomber stores.

Dimensions
Span: 67 ft. 10 in.
Length: 66 ft. 8 in.
Height: 15 ft. 7 in.
Wing area: Not released for publication.

Weights
Not released for publication.

Performance
Service ceiling: Above 50,000 ft.

Fairey Rotodyne



OCCUPYING a unique position in the field of rotary-wing aircraft, the Fairey Rotodyne is a convertiplane combining the advantages of helicopter, autorotatory, and fixed wing flight. The four-blade rotor is powered by means of pressure jets at the tips, fed by compressed air from the two Napier Eland engines for take-offs and landings, but in forward cruising flight all the engine power is applied to the two propellers and the rotor autorotates to provide some 40% of the total lift.

After a great deal of development in the wind-tunnel and on special testing rigs, the Rotodyne prototype started its ground-resonance trials on October 25, 1957, and the first flight followed on November 6. Initially, experience was built up with the aircraft flown as a helicopter, the first full transition from helicopter flight to autorotation being made on April 10, 1958. A second prototype is under construction.

Powerplant
Two 3,500-e.h.p. Napier Eland N.El.7 turboprops and two Fairey coaxial tip pressure jets.

Accommodation
40–48 passengers in four-abreast seats.

Dimensions
Rotor dia.: 90 ft. 0 in.
Wing span: 46 ft. 6 in.
Length: 58 ft. 8 in.
Height: 22 ft. 2 in.
Disc area: 6,360 sq. ft.
Wing area: 475 sq. ft.

Weights
Normal take-off: 39,000 lb.
Empty: 24,000 lb.
Disc loading: 6.13 lb./sq. ft.

Performance
Cruising speed: 160 knots at 3,000 ft.
Inclined climb: 2,400 ft./min.*
Hovering ceiling: 7,000 ft.*
Normal range: 500 n.m. with 10,000 lb. payload and S.B.A.C. reserves.
*Achieved figures with prototype at 33,000 lb., partial power.

The Fairey Gannet AEW Mk. 3

Powerplant
One 3,875-e.h.p. Armstrong Siddeley Double Mamba A.S.M.D.8.

Crew
Pilot and radar operators.

Armament
None on normal missions.

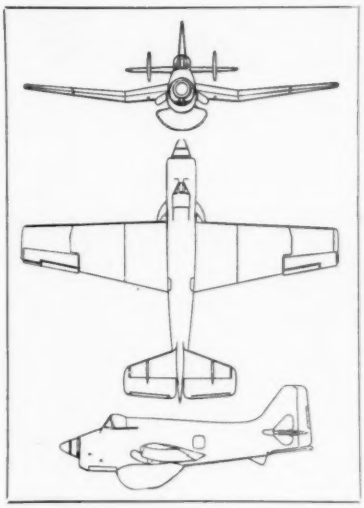
Dimensions
Span: 54 ft. 4 in.
Length: } Not released for
Height: } publication.
Wing area: }

Weights
Not released for publication.

Performance
Not released for publication.

TO replace the veteran AD-4W Skyraiders of the Royal Navy, the Fairey Gannet is being extensively modified to carry powerful radar in a ventral fairing for airborne early-warning duties. The Gannet AEW Mk. 3 will also have the rear cockpits removed and accommodation provided for radar observers in a new cabin in the fuselage. This will necessitate the relocation of the jet pipes, and the fin and rudder will be squared off.

The Gannet 3 will be used by aircraft-carrier task forces to extend the range of their defensive system, which at sea level is restricted to the normal optical horizon of about nine miles. At 500 ft., optical range becomes about 30 miles, and at 25,000 ft., radar can survey a distance of some 200 miles. AEW aircraft can therefore detect enemy machines approaching at any altitude; as airborne intelligence centres, they can direct fighters and strike aircraft on to interception courses; and seek out surface vessels and submarines.



The Fairey Ultra Light Helicopter

Powerplant
One 252-s.h.p. Blackburn-Turbomeca Palouste 500 air compressor and two Fairey pressure-jet units at the tips of the rotor.

Crew
Pilot and observer.

Armament
Nil.

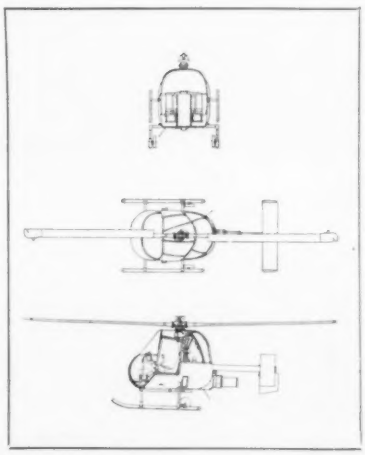
Dimensions
Main rotor diameter: 23 ft. 1 in.
Length (less rotor): 14 ft. 8 in.
Height: 8 ft. 2 in.

Weights
Empty: 950 lb.
Disposable load: 850 lb.
Gross: 1,800 lb.

Performance
Max. speed: 100 m.p.h.
Cruising speed: 86 m.p.h.
Initial climb: 1,350 ft./min.
Vertical climb: 950 ft./min.
Hovering ceiling in ground effect: 10,000 ft.
Range: 165 miles, or 100 miles with 220-lb. payload.
Endurance: 2 hr. 30 min.

ALTHOUGH primarily developed for Army observation and liaison duties, the Fairey Ultra Light is suitable for a wide range of civil applications, and has also shown a promising potential towards fulfilling certain naval requirements. Flight trials have been concluded on two occasions from the frigates H.M.S. "Grenville" and "Undaunted," the Fairey U.L. proving capable of operating from a tiny deck area of 9 ft. square, in winds of up to 62 knots, and with the ship pitching between 10 and 12 ft., and rolling 14° each way.

A small helicopter would be invaluable for reconnaissance operations from anti-submarine escort vessels, and naval procurement of the Fairey U.L. would conform to the current F.A.A. policy of using helicopters instead of fixed-wing aircraft for submarine detection and destruction.



Folland Gnat

GNAT F.1

Powerplant
One 4,520-lb. s.t. Bristol Orpheus B.Or.2 (701).

Crew
Pilot.

Armament
Two 30-mm. ADEN cannon with 115 rounds per gun, 2,000 lb. underwing bombs, rockets or other stores.

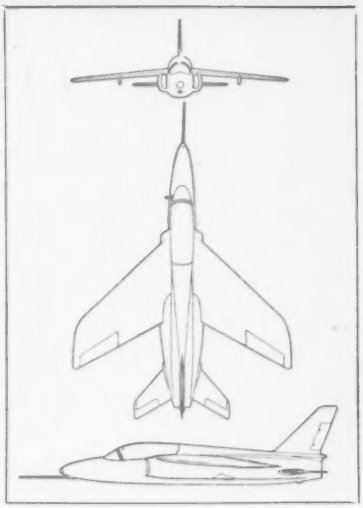
Dimensions
Span: 22 ft. 2 in. (24 ft.).
Length: 29 ft. 9 in. (30 ft. 8 in.).
Height: 8 ft. 9 in. (9 ft. 3 in.).
Wing area: 136.6 sq. ft. (175 sq. ft.).

Weights
Empty: 3,967 lb.
Gross, clean: 6,200 lb.
Gross, with external stores: 8,600 lb.

Performance
Max. speed: M=0.98 (715 m.p.h. at 10,000 ft.).
Initial climb: 15,000 ft./min.
Service ceiling: 50,000 ft.+
Take-off run: 750 yd.
Range (with external tanks): 920 miles.
Radius of action (clean): 250 miles.

SINCE the Gnat first flew on July 19, 1955, intensive design development has been continuing, and flight trials with five M.o.S. prototypes have covered virtually every aspect of performance and handling. Twenty-five Gnat 1s have been bought by India and 12 by Finland, together with the manufacturing licences, and Yugoslavia has also purchased two for evaluation.

The Gnat is to undergo competitive trials in Aden later this year in the ground-attack rôle for the R.A.F., which has also ordered 14 examples of the projected two-seat trainer version, with a 4,230-lb. B.Or.4. Details of this variant, which has outboard ailerons and conventional flaps, are shown in the three-view drawing and in parentheses alongside. Further developments include the supersonic Gnat 2, which with the reheat B.Or.2 and a 6% wing, will have an estimated level speed of M=1.25, and the Gnat 4 with A.I radar and a reheat B.Or.12, giving a maximum speed of M=1.4.



Gloster Javelin

JAVELIN FAW 7 and 8

Powerplant
Two 11,000-lb. s.t. Armstrong Siddeley A.S.Sa.7 (200 Series).

Crew
Pilot and Navigator/Radar Operator.

Armament
Four 30-mm. ADEN cannon, four D.H. Firestreak AAMs, or 50-mm. unguided rockets in underwing pods.

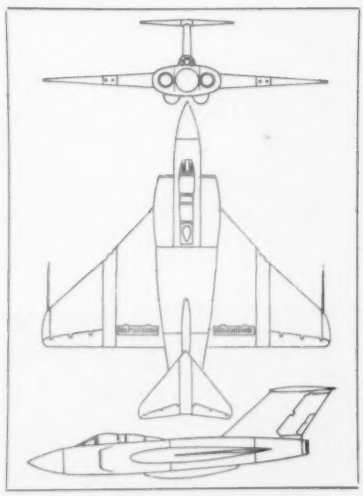
Dimensions
Span: 52 ft.
Length: 56 ft. 9 in.
Height: 17 ft. 1 in.
Wing area: Not available.

Weights
Not released for publication.

Performance
Not released for publication.

SO far there have been seven production versions of the Gloster Javelin since the prototype first flew on November 26, 1951, together with one additional variant, the T.Mk. 3 trainer, which was originally converted by Air Service Training, Ltd. The initial production Javelin 1s were built in limited numbers and served successively with two R.A.F. squadrons, but were soon superseded by the Javelin 2, with minor equipment changes. The Javelin 4 saw the introduction of an all-flying tail (also on the Mk. 3), while the Javelin 5 and 6 had a new wing with increased fuel capacity, and provision for twin 126-gal. belly tanks.

All these variants are powered by 8,300-lb. A.S.Sa.6 turbojets, but the current Mks. 7 and 8 have the additional thrust conferred by the A.S.Sa.7 engines. The two latest Javelins differ from each other in internal equipment, but both may incorporate afterburning for even greater thrust to benefit acceleration and climb.



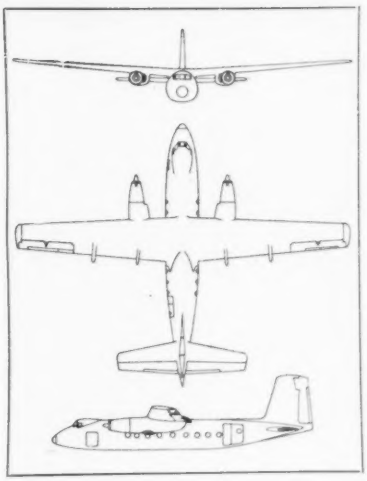
Handley Page Dart Herald

Powerplant
Two 2,105-e.h.p. Rolls-Royce Dart 527 (R.Da.7/2) turboprops.
Accommodation
36–47 passengers.
Dimensions
Span: 94 ft. 9.5 in.
Length: 71 ft. 11 in.
Height: 22 ft. 4 in.
Gross wing area: 886 sq. ft.
Weights and Loadings
Basic operational: 22,808 lb.
Total usable fuel: 8,000 lb.
Mins. max. payload: 10,160 lb.
Max. take-off: 37,000 lb.
Max. landing: 37,000 lb.
Max. zero fuel: 32,968 lb.
Wing loading (max. tak. wt.): 41.7 lb./sq. ft.
Power loading (max. t.-o. wt.): 8.8 lb./e.h.p.
Performance
Recommended cons. cruising speed (I.S.A.): 241 knots (at 15,000 ft. and 35,500 lb.); consumption: 203.6 Imp. gal./hr.; power: 13,800 r.p.m.
Balanced field lengths (at max. t.-o. wt.): At I.S.A. at sea level: 3,700 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 2,260 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,000 Imp. gal.): 1,260 n.m. with 6,095 lb. payload at 243 knots (mean) at 17,400 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A. with max. payload: 610 n.m.

HANDLEY PAGE first announced their intention of developing a short-haul medium-size transport for use in relatively under-developed areas towards the end of 1954, and a prototype of this design made its first flight on August 25, 1955. Powered by four Alvis Leonides Major piston engines, this aircraft, christened the Herald, aroused keen interest in several parts of the World, but there was subsequently a marked swing in favour of turboprops among these potential customers.

In consequence, Handley Page have now developed the Herald to have two Rolls-Royce Darts, and in this form a prototype first flew on March 11, 1958. Associated with the change in powerplant are some structural modifications and a few refinements which will be incorporated in any production aircraft.

Design and construction of the Herald is the responsibility of Handley Page (Reading), Ltd., at Woodley.



Handley Page Victor

VICTOR B.1

Powerplant
Four 11,000-lb. s.t. Armstrong Siddeley Sapphire A.S.Sa.7.

Crew
Pilot, co-pilot, nav./radar, nav. plotter, air electronics officer.

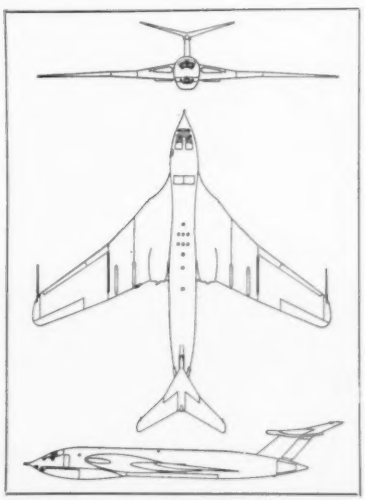
Armament
Thermonuclear, atomic and explosive bombs, and air-to-surface missiles.

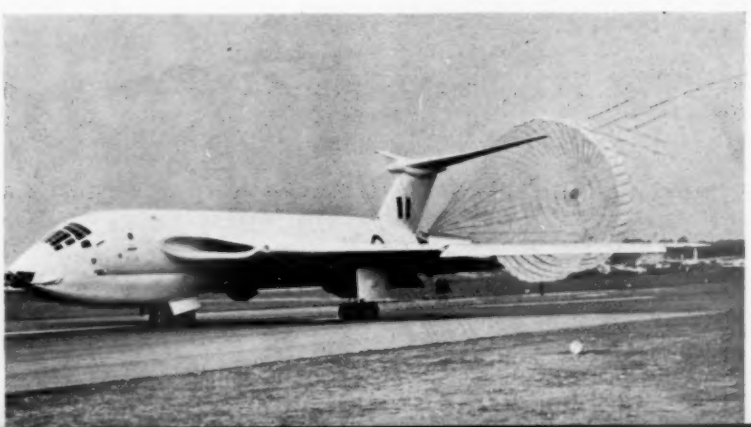
Dimensions
Span: 110 ft.
Length: 114 ft. 11 in.
Height: 28 ft. 1½ in.
Wing area: Not released for publication.

Weights and Performance
Not released for publication.

THIRD of the V-bomber series to enter service with Bomber Command, the Victor has almost undoubtedly the highest performance of any heavy bomber throughout the World, and is unique for an aircraft of its size in having been dived transonically. To be introduced alongside the Valiant squadrons in No. 3 Group, Victors are already operating at a combined O.C.U. at Gaydon, and the first operational unit, No. 10 Squadron, will be formed with these aircraft after its crews have completed their training. Like the Valiant and Vulcan, the Victor has a crew of five housed in a highly pressurized capsule in the front fuselage.

Development of the Victor is continuing, and the B.Mk.2 is being produced, with four 17,250-lb. s.t. Rolls-Royce Conway R.Co.11 turbojets. The increased power of the Victor B.2 should result in a substantially increased performance, while the "by-pass" Conways will have a reduced specific fuel consumption.





Hawker Hunter

HUNTER F.6

Powerplant
One 10,050-lb. s.t. Rolls-Royce Avon 200 Series.

Crew
Pilot.

Armament
Four 30-mm. ADEN cannon with 100 r.p.g., and 2,000 lb. of underwing bombs, rockets or other stores.

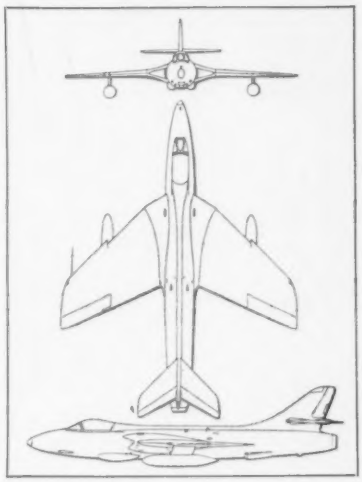
Dimensions
Span: 33 ft. 8 in.
Length: 45 ft. 10½ in.
Height: 13 ft. 1⅓ in.
Wing area: 349 sq. ft.

Weights
Reported as empty (approx.): 13,500 lb.
Gross: 17,800 lb.
Overload: 23,700 lb.

Performance
Max. level speed: M=0.95 (720 m.p.h. at sea level).
Initial climb (est.): 15,000 ft./min.
Service ceiling: 50,000 ft.+

MAINSTAY of the R.A.F. day interceptor force, the Hunter has also been supplied to Denmark, India, Iraq, Peru, Sweden and Switzerland, in addition to its construction in Belgium and the Netherlands for the air forces of those countries. There have been five basic production variants of the Hunter fighter, comprising the Mks. 1 and 4, with the 100-Series Avon, the Mks. 2 and 5 with the 100-Series Sapphire, and the current Mk. 6, with the 200-Series Avon. The Mk. 3 was a "one-off" design with a reheat Avon R.A.7R, and in 1953 established World records at 727.6 and 709 m.p.h. over straight and closed-circuit courses.

Export versions of the Hunter include Mk. 4s supplied to Sweden as the F.Mk. 50; to Denmark as the F.Mk. 51; and to Peru as the F.Mk. 52, while India has received F.Mk. 56s conforming generally to Mk. 6 standards. Iraq received a squadron of Hunter 6s direct from the R.A.F. in 1957-58.



Hawker Hunter Trainer

HUNTER T. Mk. 7

Powerplant
One 8,050-lb. s.t. Rolls-Royce Avon 115

Crew
Instructor and student.

Armament
One 30-mm. ADEN cannon, underwing bombs, rockets or other stores.

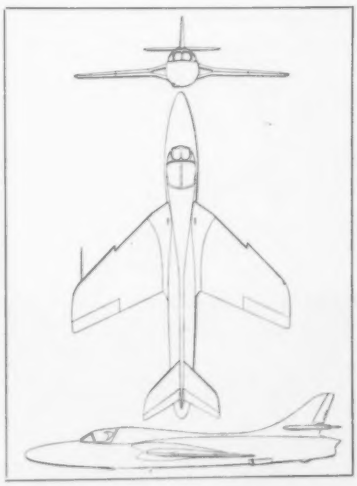
Dimensions
Span: 33 ft. 8 in.
Length: 48 ft. 10½ in.
Height: 13 ft. 2 in.
Wing area: 349 sq. ft.

Weights (Est.)
Tare: 13,000 lb.
Gross: 18,200 lb.

Performance (Est.)
Max. speed: M=0.95 at sea level.
Cruising speed: 490 knots.
Initial climb: Not available.
Service ceiling: 50,000 ft.+
Range (clean): 550 miles.

BY replacement of the forward fuselage with a wider section containing two seats side-by-side, with full dual control, the Hunter has been simply developed into a versatile and useful trainer for advanced jet, instrument, and armament training. The first prototype of the Hunter Trainer was adapted from a Mk. 4 airframe, with an Avon 113 or 115, and a second prototype was developed from a Mk. 6 Hunter, with the more powerful 200-Series Avon. The lower-powered variant, however, has been selected for production by the R.A.F., as the Hunter T.7, and for the Dutch, Danish and Indian Air Forces, while with similar power, the Hunter T.8 will be used for advanced training by the Royal Navy.

Like the later versions of the Hunter fighter, the T.7 and T.8 have a "saw tooth" wing and "flying tail" to improve stability and control at extremes of performance, and are similarly transonic in a shallow dive.



Hunting Jet Provost

JET PROVOST T.3

Powerplant
One 1,750-lb.s.t. Armstrong Siddeley Viper 8 turbojet.

Crew
Two.

Armament
Standard—2 × .303 machine guns, plus various alternatives. For example, 8 × 25 lb. bombs; or 6 × Mk. 8 R.P.s; or 12 × Mk. 5 R.P.s.; or 8 × 25 lb. bombs + 4 × Mk. 8 R.P.s; or 8 × 25 lb. bombs + 8 × Mk. 5 R.P.s.

Dimensions
Span: 36 ft. 11 in.
Length: 32 ft. 5 in.
Height: 10 ft. 2 in.
Wing area: 213.7 sq. ft.

Weights
Max. take-off: 6,195 lb.*
Empty (operational): 4,347 lb.

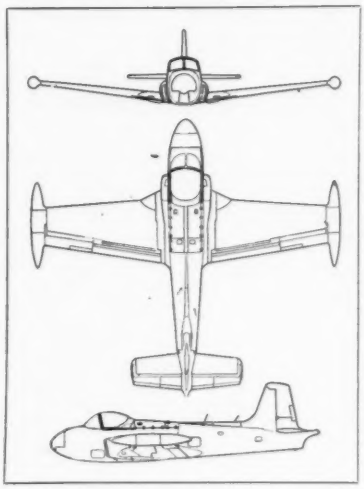
Performance
Max. speed: 286 knots at 30,000 ft.
Cruising speed: 145 knots E.A.S.
Initial climb: 2,380 ft./min.
Service ceiling: 35,000 ft.
Take-off to 50 ft.: 1,990 ft.
Range: 490 n.m. at 25,000 ft.†

* Without slip tanks.
† With slip tanks.

DEVELOPED from the Provost basic trainer with a radial piston engine, the turbojet-powered Jet Provost has been selected as the standard basic trainer for the Royal Air Force in accordance with its all-through jet training scheme.

An initial batch of Jet Provost Mk. 1s with the original long, fixed, undercarriage was built and evaluated by the C.F.S. Subsequently the Mk. 2 version with a shortened and retractable undercarriage was produced and earlier this year the first production aircraft for the R.A.F. made its maiden flight. This is the Mk. 3 Jet Provost which has a one-piece moulded windscreen and Martin-Baker ejection seats. Particular attention has been paid in the detail layout of the Jet Provost to ease of accessibility of essential components and services.

Recently a Jet Provost completed a lengthy demonstration tour of Argentina and other South American countries where it was received with a great deal of interest.



Hunting President

Powerplant
Two 540-b.h.p. Alvis Leonides 504/5A piston engines.

Accommodation
Up to 12 passengers.

Dimensions
Span: 64 ft. 6 in.
Length: 46 ft. 0 in.
Height: 16 ft. 0 in.
Gross wing area: 400 sq. ft.

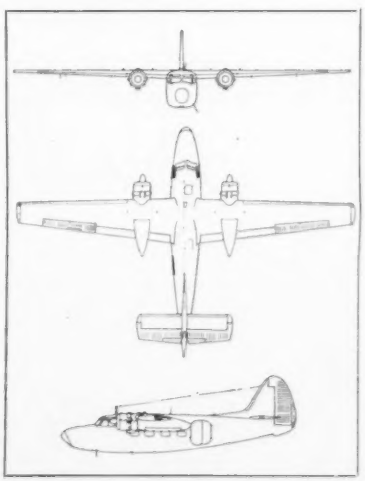
Weights and Loadings
Basic operational: 9,136 lb.
Total fuel: 1,670 lb.
Mtrs. max. payload: 3,800 lb.
Max. take-off: 13,500 lb.
Wing loading (max. t-o. wt.): 33.7 lb./sq. ft.
Power loading (max. t-o. wt.): 12.7 lb./b.h.p.

Performance
Recommended cont. cruising speed (I.S.A.): 143 knots (at 8,000 ft. and 13,000 lb.); consumption: 30 Imp. gal./hr.; power (per engine): 245 b.h.p.
Balanced field length (at max. t-o. wt.): At I.S.A. at sea level: 3,800 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 2,525 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (238 Imp. gal.): 1,070 n.m. with 2,500 lb. payload at 143 knots (mean) at 8,000 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 833 n.m.

MAKING its first public appearance at the S.B.A.C. Display two years ago the Hunting President is a logical civil development of the Pembroke Service transport. It is intended primarily as a light transport for use on feeder routes or for executive use.

Various other versions are available. For example, it is particularly well suited as an aerial-survey craft, in which case provision is made for the installation of vertical and oblique cameras. As an air ambulance the President can offer accommodation for six stretcher cases. And if required for light freight-carrying the cabin, stripped of seats, provides some 660 cu. ft. of usable volume.

The earlier, military, forerunner of the President is in service as the Pembroke with the R.A.F. and the Air Forces of Southern Rhodesia, Sweden, Denmark, Belgium, Finland and Germany. Others have been used for aerial survey work.



Miles Student

Powerplant
One 883-lb.s.t. Blackburn Turboméca Marboré IIA turbojet.

Crew
Two.

Armament
Two Oerlikon Pods with 31 5-cm. R.P.s each; or 6×25-lb. R.P.s; or 4×60-lb. R.P.s; or 8×25-lb. bombs. With all these 2×.303 machine guns can be carried.

Dimensions
Span: 29 ft. 2 in.
Length: 31 ft. 6 in.
Height: 6 ft. 3 in.
Wing area: 144 sq. ft.

Weights
Normal all-up: 3,600 lb.*
Empty (operational): 2,400 lb.

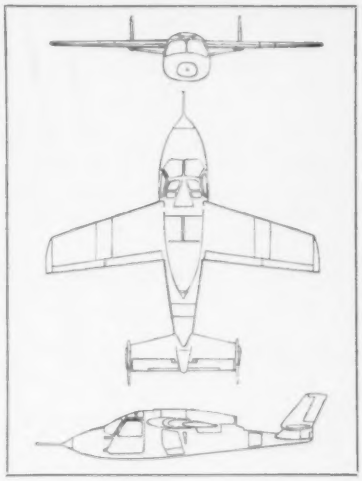
Performance
Max. speed: 290 m.p.h. at S.L.
Cruising speed: 253 m.p.h. at S.L.; 262 m.p.h. at 20,000 ft.
Service ceiling: 30,000 ft.
Take-off to 50 ft.: 740 yd. (still air).
Range: 444 miles with internal fuel; 621 miles with tip tanks.

* 3,900 lb. overload.

DESIGNED specifically as a basic jet trainer for Service use in an all-through training scheme, the Student is a most lively little aeroplane with side-by-side seating.

Its general arrangement is somewhat unorthodox in having the engine located above and behind the cabin. This, however, makes for ease of servicing and maintenance and enables the air intake—which is of the flush type—to be sited above the canopy and thus eliminate the problems of the ingestion of stones and other foreign particles thrown up from the runway.

Another feature of the aircraft is the easy access to the pilots' seats provided by the wide car-type doors on each side of the cabin. These doors can be jettisoned for emergency escape. If required the Student can be converted into a four-seater—with the two extra seats installed in the space normally occupied by equipment behind the pilots.



Saunders-Roe P.531

Powerplant
One Blackburn Turboméca Turmo free-turbine engine: 1-hr. power rating 425 s.h.p.

Accommodation
Five, including pilot.

Dimensions
Rotor diameter: 32 ft. 6 in.
Length: 29 ft. 0 in.
Height: 9 ft. 6 in.
Disc area: 827 sq. ft.

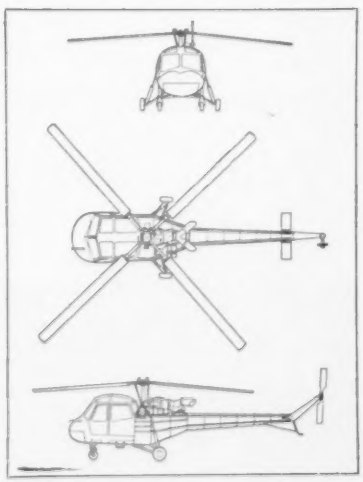
Weights
Normal take-off: 3,800 lb.
Empty weight: 2,092 lb.
Disc loading: 4.6 lb./sq. ft.

Performance
Cruising speed: 100 knots.
Inclined climb: 1,600 ft./min.
Service ceiling: 18,000 ft.
Normal range: 210 n.m.

INTENDED primarily for military duties, the Saunders-Roe P.531 has been built as a private venture. It is a five-seat turbine-powered helicopter designed to meet inter-Service requirements. Operational rôles will include liaison, light freighting, training, casualty evacuation, air-sea rescue, reconnaissance and weapon-carrying.

Two P.531 prototypes have been built with Blackburn Turmo free-turbine engines de-rated to 300 h.p. A third P.531 with a fully rated Turmo is expected to fly early next year; it will be representative of the first production helicopters.

Airframe and transmission of the P.531 have been designed to take powers of 600-650 s.h.p. This built-in development potential will allow power units of up to 1,000 s.h.p. to be installed in due course. With such a powerplant, de-rated for temperate operation, the performance will be maintained virtually regardless of climatic conditions.



Saunders-Roe Skeeter 12

Powerplant
One 215-b.h.p. D.H. Gipsy Major 215 four-cylinder in-line engine.

Accommodation
Two seats (including pilot) side by side

Dimensions
Rotor dia.: 32 ft.
Length: 26 ft. 8 in.*
Height: 9 ft.†
Disc area: 805 sq. ft.

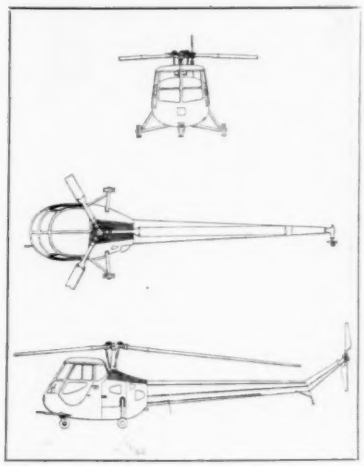
Weights
Normal take-off: 2,300 lb. (2,300 lb. max.).
Empty: 1,656 lb.
Disc loading: 2.86 lb./sq. ft. (max.).

Performance
Cruising speed: 101 m.p.h.
Inclined climb: 1,150 ft./min.
Absolute ceiling: 14,000 ft.
Normal range: 185 miles with normal tanks.

* With blades folded, tail rotor vertical.
† With tail rotor vertical.

IN production at Cowes and Eastleigh, the Skeeter 12 has been chosen for the British Army Air Corps for light liaison duties and as an air-observation post. It has also been ordered by the West German Federal Government—10 for use by their Army in the Heeres-flieger-kommando and four by their Navy. Of these aircraft, five were scheduled for delivery by the end of this month. The total number of Skeeters being built for the British Army has not been announced but it is said to be a substantial quantity. Some of these have already been delivered.

The Skeeter employs the classic helicopter layout with a single (three-bladed) main rotor in conjunction with a tail anti-torque rotor. Saunders-Roe and the Napier company have also developed for the Skeeter a rotor-tip hydrogen peroxide rocket system for boosting the take-off performance should this be required—for example, under high-altitude tropical conditions.



Scottish Aviation Twin Pioneer

Powerplant
Two 540-b.h.p. Alvis Leonides 514/8.

Accommodation
Up to 16 passengers.

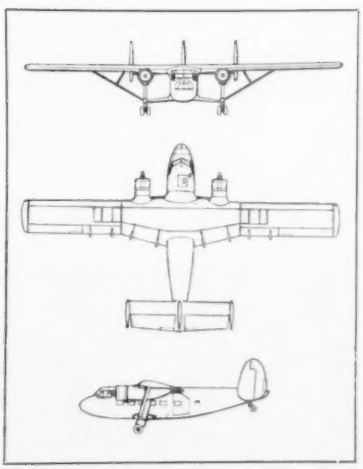
Dimensions
Span: 76 ft. 6 in.
Length: 48 ft. 3 in.
Height: 12 ft. 3 in.
Gross wing area: 670 sq. ft.

Weights and Loadings
Basic operational: 9,502 lb.
Trust fuel: 1,296 lb.
Nfrs. max. payload: 3,258 lb.
Max. take-off: 13,500 lb.
Max. landing: 13,500 lb.
Max. zero fuel: No restriction.
Wing loading (max. t-o. wt.): 20.1 lb./sq. ft.
Power loading (max. t-o. wt.): 12.7 lb./b.h.p.

Performance
Recommended cont. cruising speed (I.S.A.): 102 knots (at 5,000 ft. and 13,500 lb.); power (per engine): 48% METO.
Take-off distance to 50 ft. plus 25% (I.S.A., s.l.): 1,272 ft.
Landing distance from 50 ft. (un-factored, max. landing wt.): 1,170 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (747 Imp. gal.): 795 n.m. with 1,850 lb. payload at 102 knots (mean) at 5,000 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 30 n.m.

NOTEWORTHY for its extremely short take-off and landing characteristics, the Twin Pioneer first flew in June, 1955, and three pre-production aircraft were flown by the end of the following year. Since then about 55 of these aircraft have been ordered, including 32 for the R.A.F., and are in service in many parts of the World. The aircraft has been specifically designed to operate from rough airstrips and to have a single-engine performance that would meet transport category requirements.

Among operators and potential operators of Twin Pioneers are de Kroonduif of New Guinea, Borneo Airways, Philippine Air Lines, Fison-Airwork and Scottish Airlines. For Philippine Air Lines—who have ordered five aircraft—a special version of the Twin Pioneer is being developed. This will be powered by Pratt & Whitney Twin Wasp radials instead of the standard Alvis Leonides.



Supermarine Scimitar

Powerplant
Two 11,250-lb.s.t. Rolls-Royce Avon 200 series.

Crew
Pilot.

Armament
Four 30 mm. ADEN cannon, nuclear weapons, bombs, rockets and other stores.

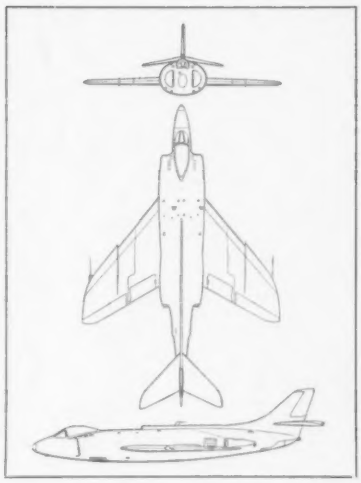
Dimensions
Span: 37 ft. 2 in.
Length: 55 ft. 4 in.
Height: Not available.
Wing area: Not available.

Weights
Not released for publication.

Performance
Not released for publication.

NO. 803 Squadron of the Fleet Air Arm recently became the first operational unit to equip with the Supermarine Scimitar strike fighter, which is the Royal Navy's first transonic aeroplane. The Scimitar is also the heaviest aircraft yet operated by the F.A.A., although it is only a single-seater, and it has the heaviest punch, since it is designed to carry nuclear weapons in addition to conventional strike armament.

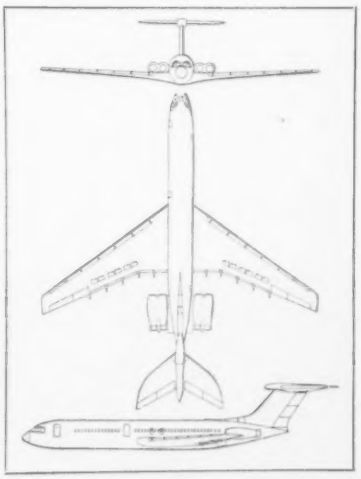
Low-speed performance of the Scimitar is greatly improved by super-circulation, or blown flaps from compressor air, and it also incorporates a drooping leading edge. For its intended rôle long range is a particularly important requirement, and successful tests have been completed with a Scimitar fitted with a nose probe for flight refuelling. Provision is also made for the carriage of four large fuel tanks beneath the wings to augment the internal tankage as an alternative to other external stores.



Vickers V.C.10

THE most advanced commercial transport under development in Britain at the present time is the Vickers V.C.10, for which B.O.A.C. signed an initial contract on January 14, 1958. This contract calls for delivery of 35 aircraft, with an announced value, including spares, of £60 million, spread over the years 1963-65. There is also an option on 20 more V.C.10s for B.O.A.C.

Although the design was originally laid out to meet the Corporation's requirement for medium-long haul transport on the Commonwealth routes, the V.C.10 has now been stretched to make it suitable for non-stop North Atlantic operations. Particular attention is being given by Vickers to the take-off performance, especially at high altitudes and high temperatures, and in this respect, as well as the designed cruising speed, the V.C.10 is expected to have a significant advantage over the first generation long-haul turbojet transports.



Powerplant
Four 16,750-lb.s.t. Rolls-Royce Conway R.Co.16 turbojets.

Accommodation
100 first-class passengers or 135 in standard high-density seating or 152 in extra high-density seating.

Dimensions
Span: 140 ft.
Length: 160 ft.
Height: 41 ft. 2 in.
Wing area: 2,800 sq. ft.

Weights
Max. take-off: 299,000 lb.

Performance
Not released for publication.

Vickers V.950 Vanguard

Powerplant
Four 5,525-e.h.p. Rolls-Royce Tyne R.Ty.11 turboprops.

Accommodation
97–139 passengers.

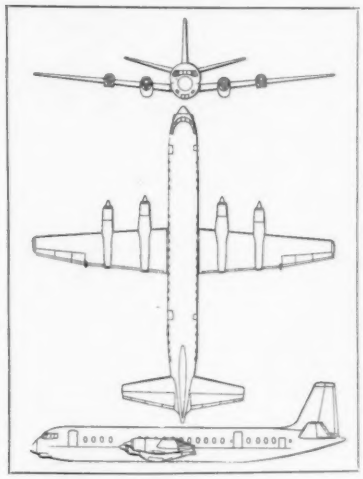
Dimensions
Span: 118 ft. 0 in.
Length: 122 ft. 10.4 in.
Height: 34 ft. 11 in.
Gross wing area: 1,529 sq. ft.

Weights and Loadings
Basic operational: 83,500 lb.
Total fuel: 40,800 lb.
Mfrs. max. payload: 29,000 lb.
Max. take-off: 141,000 lb.
Max. landing: 121,000 lb.
Max. zero fuel: 112,500 lb.
Wing loading (max. t-o. wt.): 92.2 lb./sq. ft.
Power loading (max. t-o. wt.): 6.37 lb./e.h.p.

Performance
Recommended cont. cruising speed (I.S.A.): 367 knots (at 20,000 ft. and 121,000 lb.); consumption: 710 Imp. gal./hr.
Balanced field length (at max. t-o. wt.): At I.S.A. at sea level: 6,000 ft.
Landing distance from 50 ft. (unfactored, max landing wt.): 3,300 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (5,100 Imp. gal.): 3,330 n.m. with 19,100 lb. payload at 350 knots (mean) at 30,000 ft. (mean).
Range (take-off to landing), still air, no reserves, I.S.A., with max. payload: 2,540 n.m. at 343 knots at 30,000 ft.

DESIGNED to meet B.E.A.'s particular requirements for a large-capacity medium-haul turboprop transport, the V.950 Vanguard has also been developed to fulfil the needs of operators in other parts of the World. A special feature of this aircraft is its ability to carry a full passenger payload with ample capacity—both in volume and weight—for freight. The large freight hold makes it possible to accommodate a near-maximum payload of cargo so that passenger and freight loads are, in effect, interchangeable.

Twenty Vanguards are on order for B.E.A., the first of which is scheduled for delivery to the Corporation early in 1960; B.E.A. also have an option on a further 10. Trans-Canada Air Lines have also ordered 20 Vanguards, with an option on four more, delivery of which is scheduled to start late in 1960 for introduction into service in 1961. The prototype V.950 is expected to fly towards the end of this year.



Vickers Viscount 810 Series

Powerplant
Four 1,990-e.h.p. Rolls-Royce Dart 525 (R.Da.7) turboprops.

Accommodation
58–75 passengers.

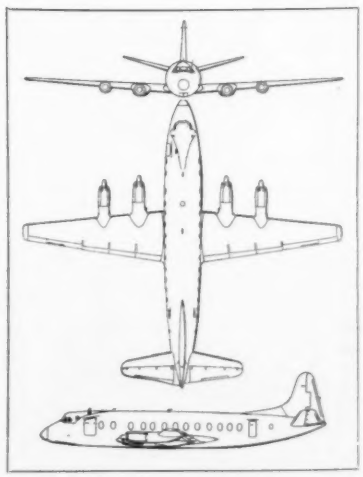
Dimensions
Span: 93 ft. 8½ in.
Length: 85 ft. 6 in.
Height: 26 ft. 9 in.
Gross wing area: 963 sq. ft.

Weight and Loadings
Basic operational: 41,274 lb.
Total fuel: 15,256 lb.
Mfrs. max. payload: 15,054 lb.
Max. take-off: 69,000 lb.
Max. landing: 62,000 lb.
Max. zero fuel: 57,500 lb.
Wing loading (max. t-o. wt.): 71.5 lb./sq. ft.
Power loading (max. t-o. wt.): 8.67 lb./e.h.p.

Performance
Recommended cont. cruising speed (I.S.A.): 305 knots (at 20,000 ft. and 62,000 lb.); consumption: 380 Imp. gal./hr.
Balanced field length (at max. t-o. wt.): At I.S.A. at sea level: 5,350 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 3,300 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (1,907 Imp. gal.): 1,640 n.m. with 10,900 lb. payload at 295 knots (mean) at 26,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. payload: 1,210 n.m.

LATEST in the range of Viscount variants, the 800 Series aircraft has an added 46-in. bay in the fuselage which helps to give no less than 108 in. of extra available interior length compared with that in the earlier 700 Series aircraft. The newest versions of the Viscount 800 are the 810 and 840—the former having Dart 525 turboprops and the latter Dart 541s. In effect the Viscount 810/840 offers the passenger capacity of the original short-haul high-density Viscount 800 coupled with the range performance of the developed 700s and a higher cruising speed.

In developing this new 810/840 Series, Vickers have succeeded in embodying a number of detail refinements in the airframe so that the take-off weight and limiting airspeeds for the aircraft have been substantially increased. Some 400 Viscounts of various types are in service or on order. Of these more than 140 are 800s, including 42 802s and 806s for B.E.A. and 15 812s for Continental.



Vickers Valiant

Powerplant
Four 10,000-lb. s.t. Rolls-Royce Avon 200 Series.

Crew
Pilot, co-pilot, nav./plotter, nav./radar, A.E.O.

Armament
Thermonuclear, atomic or explosive bombs, and air-to-surface missiles.

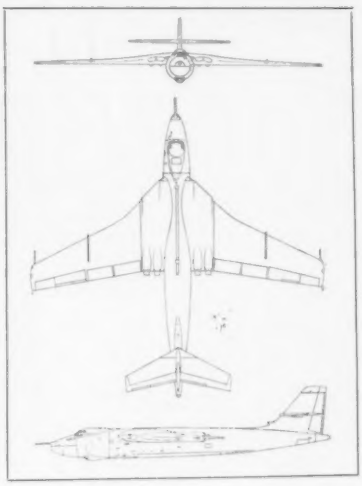
Dimensions
Span: 114 ft. 4 in.
Length: 108 ft. 3 in.
Height: 32 ft. 2 in.
Wing area: 2,362 sq. ft.

Weights
Gross: More than 120,000 lb.

Representative performance
Max. speed: M=0.9.
Cruising speed: M=0.78.
Initial climb: 5,000 ft./min.+.
Service ceiling: 45,000 ft.+.
Take-off to 50 ft. } Not released for
Range } publication.

PRODUCTION of the Valiant—first of the V-bombers—is now complete, and eight squadrons in No. 3 Group, Bomber Command, are completely equipped with this excellent medium bomber. The Valiant is the only V-bomber to have had an operational baptism, which occurred at the time of the Suez crisis in 1956, when it operated in its secondary rôle of high explosive bombing by visual means.

Several variants of the basic Valiant Mk. 1 are in service. After the B.1 came the B(PR.) aircraft, which is equipped for both bombing and photographic-reconnaissance duties, and this was followed by the B(PR.)K.1 with additional provision for flight refuelling equipment. The final BK.1 is similar, except for its lack of camera facilities, and flight refuelling with the probe and drogue system is being widely developed for the V-force. Every Valiant can be adapted to receive or supply fuel in flight, and many are equipped for this.



Westland Westminster

Powerplant
Two Napier Eland N.El.6, 3,150 s.h.p. each for take-off.

Accommodation
Up to 45 passengers.

Dimensions
Rotor diameter: 72 ft.
Length: 86 ft. 9 in.
Height: 22 ft. 3 in.
Disc area: 4,070 sq. ft.

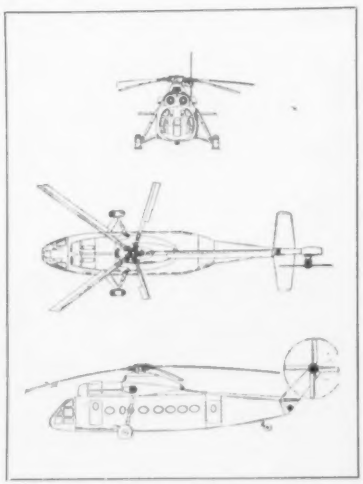
Weights
Normal take-off: 33,000 lb.
Empty weight: 21,245 lb.
Disc loading: 8.11 lb./sq. ft

Performance
Cruising speed: 130 knots.
Inclined climb: 2,480 ft./min
Service ceiling: 17,000 ft.
Normal range: 339 n.m.

BUILT as a private venture by Westland, the Westminster helicopter embodies the well-tried rotor and control systems of the Sikorsky S.58. The Westminster is to be developed both in utility form, with a tubular-frame fuselage, and as a transport helicopter.

Two prototypes with tubular-frame fuselages are to be built. The first made its initial flight on June 15 this year; the second will be representative of the utility, or flying-crane, version. Experience with these prototypes will be used in designing the stressed-skin fuselage of the transport Westminster (see drawing version of this), which will carry up to 45 passengers.

Westland development of autopilot, navigation and blind-flying systems for helicopters will be applicable to the Westminster; these features and its single-engined performance will make it particularly suitable for all-weather transport operations.



Westland Wessex

Powerplant
One 1,450-s.h.p. Napier Gazelle N Ga.13 free turbine engine.

Accommodation
Two crew members on flight deck. Accommodation for up to 12 seats in cabin or for 17 troops.

Dimensions
Rotor dia.: 56 ft.
Length: 65 ft. 9 in.
Height: 15 ft. 10 in.*
Disc area: 2,460 sq. ft.

Weights
Normal take-off: 13,600 lb.
Empty (operational): 8,350 lb.; 7,800 lb. (civil version).
Disc loading: 5.13 lb./sq. ft.

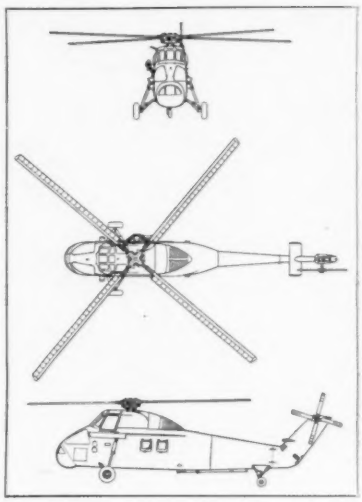
Performance:
Cruising speed: 110 knots.
Inclined climb: 1,650 ft./min.
Service ceiling: 17,000 ft.
Normal range: 350 n.m. or 550 n.m. with 200 gal. additional fuel.

* As tail rotor.

ORDERED into production for the Royal Navy, the Westland Wessex is intended for anti-submarine duties. It has been based on the Sikorsky S-58, for which the company has a manufacturing licence, but being turbine-powered, it represents a completely new type.

The initial Westland-built Wessex made its first flight during the last week in June; the prototype—which had an American airframe—was flown for the first time with a Napier Gazelle powerplant in May last year. Although the effort to begin with at Yeovil will be to deal with the Naval production requirements, a civil version of the Wessex is projected. This version, with accommodation for 12 passengers or 2½ tons of freight, will have a better performance than its American counterpart in the form of the piston-engined Sikorsky S-58.

A Wessex went to Germany in July for evaluation by the German Armed Forces.



Westland Widgeon

Powerplant
One 315-s.h.p. Alvis Leonides 521/2 radial.

Accommodation
Pilot and four passengers.

Dimensions
Rotor dia.: 49 ft. 2 in.
Length: 37 ft. 8 in.
Height: 13 ft. 4 in.*
Disc area: 1,900 sq. ft.

Weights
Normal take-off: 5,900 lb.
Empty: 4,322 lb.
Disc loading: 3.1 lb./sq. ft.

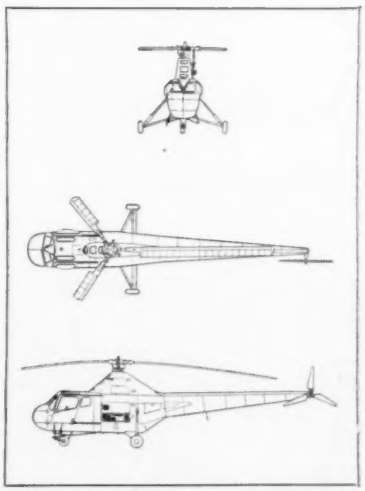
Performance
Cruising speed: 88 m.p.h.
Inclined climb: 1,190 ft./min.
Absolute ceiling: 12,800 ft.
Normal range: 260 n.m. with standard tanks or 370 n.m. with 30 gal. auxiliary fuel.

* As the main rotor.

BY designing a new cabin for the ubiquitous S-51 Dragonfly, which enabled a fourth passenger to travel, Westland has greatly enlarged the potential scope of the aircraft and provided it with a versatility that has proved very popular. And as the new front fuselage has been engineered to pick up on the original main cabin bulkhead it is possible to convert a Dragonfly into a Widgeon with a minimum of alteration. Detail refinements in the later type also include a Whirlwind-type rotor head carrying metal blades.

Widgeons, which are in production at Yeovil, have been ordered by the Hong Kong Government; by the Brazilian Navy; by a Japanese civilian operator, and by Bristow Helicopters, Ltd. The Jordanian Air Force has one and Sabena is operating a Widgeon during the period of the Brussels Exhibition.

If required the Widgeon can be supplied as an air ambulance with accommodation for two stretchers and a medical attendant.



Westland Whirlwind

WHIRLWIND H.A.S.7

Powerplant
One 715-b.h.p. Alvis Leonides Major 755/4 radial.

Accommodation
Two on flight deck
Civil version can accommodate 8-10 passengers in cabin.

Armament
Anti-submarine homing torpedo.

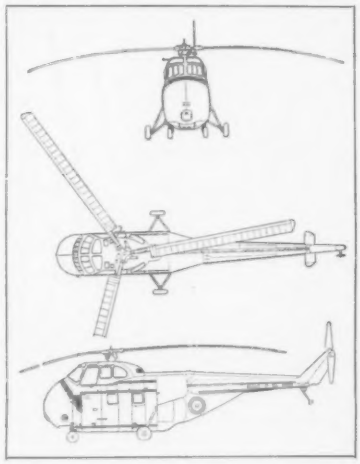
Dimensions
Rotor dia.: 53 ft.
Length: 62 ft.
Height: 15 ft. 7½ in.
Disc area: 2,210 sq. ft.

Weights
Normal take-off: 7,800 lb.*
Empty (operational): 5,375 lb
Disc loading: 3.53 lb./sq. ft.

Performance
Cruising speed: 86 knots.
Inclined climb: 1,200 ft./min.
Absolute ceiling: 13,200 ft.
Normal range: 290 n.m. at 75 knots.
* Being cleared at 8,400 lb. for military operation.

THE latest in the Whirlwind series produced at Yeovil is the H.A.S.7, which is in service with the Royal Navy as an anti-submarine craft—and is, in fact, the first British helicopter designed specifically for this task. The anti-submarine weapon that is carried is in the form of a homing torpedo, and the Whirlwind 7 is fully equipped with the latest sonar detection gear. Compared with earlier Whirlwinds, apart from the installation of the Leonides Major powerplant, the principal differences lie in some structural modification to the lower part of the fuselage to accommodate the special weapons and equipment, and in a rearrangement of fuel tanks.

A transport version of the Whirlwind with Leonides Major engine and accommodation for 10-12 passengers is also available. Six machines of this type have, for example, been ordered by the Austrian Air Force.



Research Aircraft, Prototypes and Projects

Fairey F.D.2

Powerplant
One Rolls-Royce Avon with reheat.

Crew
Pilot.

Armament
Nil.

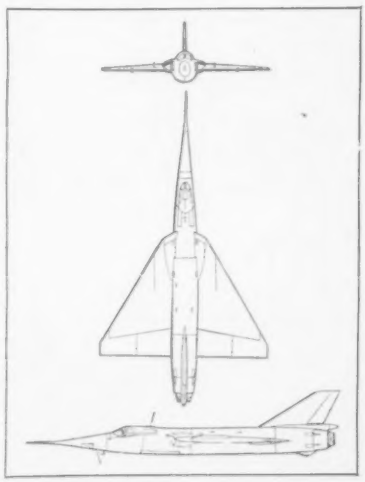
Dimensions
Span: 26 ft. 10 in.
Length: 51 ft. 7½ in.
Height: 11 ft. 0 in.
Wing area: 360 sq. ft.

Weights
Not available.

Performance
Max. speed: 1,132 m.p.h. at 38,000 ft. (M = 1.73).
No other details released for publication.

APART from its achievement in establishing the World's first absolute speed record above 1,000 m.p.h., the Fairey Delta 2 is a remarkable aeroplane in many other ways. Its design has remained virtually unchanged since its finalization in December, 1949, and there have been almost no modifications since the first flight by WG774 on October 6, 1954. In all, three F.D.2s were built, one of which was used for structural test purposes to destruction, while the second, WG777, first flew on February 15, 1956. This prototype subsequently established the record speed of 1,132 m.p.h. on March 10, 1956, which remained unbeaten for nearly two years.

With its 4% wing, the F.D.2 is still one of the most advanced designs flying, and has flown supersonically in level flight down to as low as 3,500 ft. The two prototypes operating extensively from R.A.E., Bedford, are continuing their invaluable research programme.



Hawker P.1121

FOR some time it has been known that Hawkers have been working on the P.1121, a private-venture strike aeroplane powered by a D.H. Gyron turbojet. At the time of going to press, no details of the P.1121 were available, but it is possible to guess at the probable layout of the aircraft.

Flying surfaces are almost certainly very similar in shape to those of the Hunter, although probably of lower aspect ratio and thickness/chord ratio to suit supersonic requirements. Locations of wing and tailplane are sure to be reversed in that the (doubtless slab-type) tailplane will be set below the wing.

The P.1121 air intake would be best positioned under the belly of the aeroplane, leaving the fuselage nose free to carry radar and to provide as finely pointed a shape as possible.

A ventral intake would allow control circuits to be run along the top of the fuselage to the tail unit (as with the Hunter) and would avoid the dorsal intake danger of high suction loads on the cockpit canopy—though the chance of ingesting airfield debris at take-off and landing has to be considered.

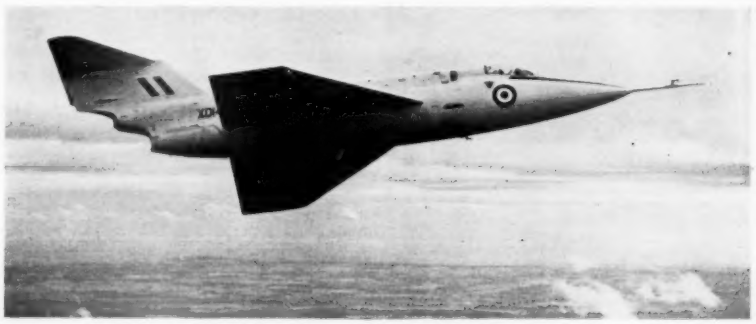
Strike requirements would seem to call for transonic speed at sea level, and Mach 2.5 or more at great height. The P.1121 would, therefore, be a good application for supersonic Area-rule treatment, with resultant slight bulging of the rear fuselage.

Weapons and extra fuel would best be carried on under-wing pylons. This would allow the maximum of fuselage stowage for fuel, the thin wings offering little help in this respect.

Work is still proceeding on the P.1121 and it is to be hoped that at least one will be completed and flown. An alternative powerplant for long-range work is the Rolls-Royce Conway R.Co.11 military by-pass engine with afterburning.

Saro S-R.53

BUT for the stringent economies forced upon our defence expenditure, the military development of the Saunders-Roe S-R.53, the P.177, might well have taken its place in operational squadrons as the first British rocket fighter. After cancellation of the development contract, flight trials of the two prototypes continued for research purposes, but these were interrupted by the take-off accident which destroyed one of the aircraft.



Powerplant
One 8,000-lb. de Havilland Spectre liquid rocket engine and one 1,750-lb. s.t. Armstrong Siddeley Viper.

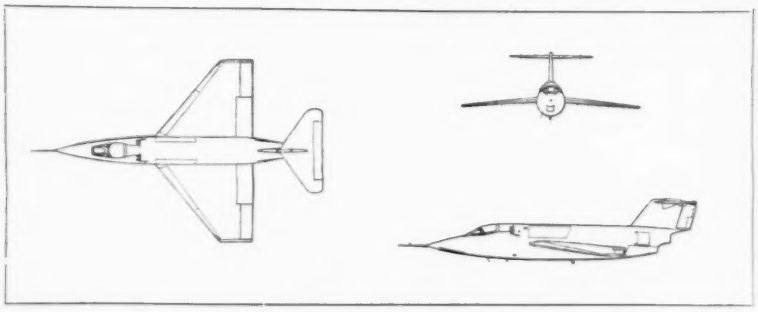
Crew
Pilot.

Armament
Two D.H. Firestreak AAMs carried on wing-tip launching shoes.

Dimensions
Span: 25 ft. 1½ in.
Length: 45 ft.
Height: 10 ft. 10 in.
Wing area: Not available.

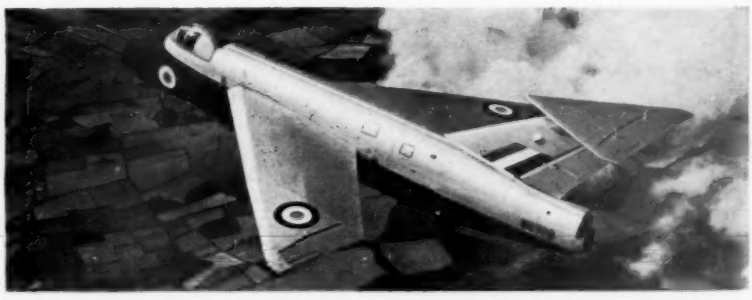
Weights
Not released for publication.

Performance
Not released for publication.



Short SB.5

DESIGNED and built in the first place to test the low-speed aerodynamics of the P.1, the Short SB.5 is continuing to fly on research duties, and is now being modified to have an Orpheus instead of a Derwent, and a 69° swept wing. With a low-set tailplane this will be its final configuration, following the installation of a 50° wing and high tail and a 60° wing with alternate high and low-set tailplane.



Powerplant
One 4,850-lb. s.t. Bristol Orpheus B.Or.3 turbojet.

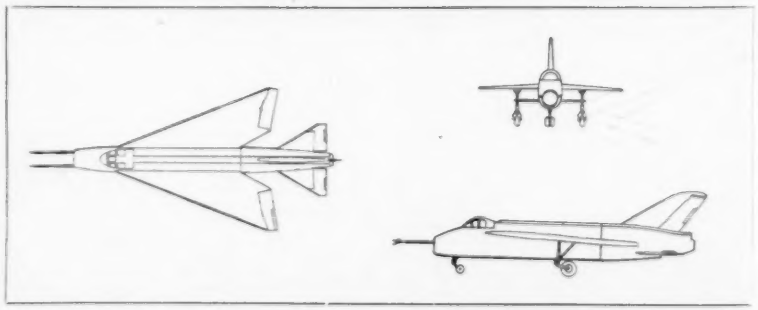
Crew
Pilot.

Armament
Nil.

Dimensions
Span: 25 ft. 11½ in.
Length: 47 ft. 4 in.
Height: 16 ft. 7 in.
Wing area: Not available.

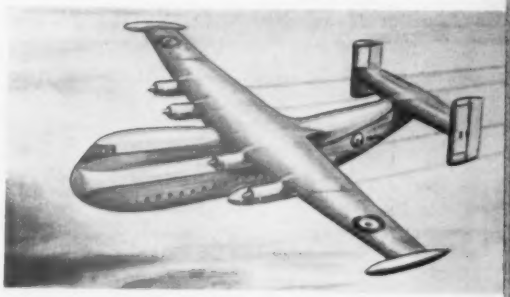
Weights
Not released for publication.

Performance
Not released for publication.



Blackburn B.107

DESIGNED specifically to fulfil the Service needs for a tactical and strategic transport, the Blackburn and General Aircraft B.107 will have short take-off and landing capabilities combined with long range and relatively high cruising speed characteristics. The design is based on the Beverley wing and tail unit with a completely new fuselage. The principal feature of the B.107 is its large unobstructed freight hold which can be used to accommodate a variety of loads varying from 108 troops to a large caterpillar tractor and bulldozer.



Powerplant
Four 4,985-e.h.p. Rolls-Royce Tyne R.Ty.11 turboprop engines.

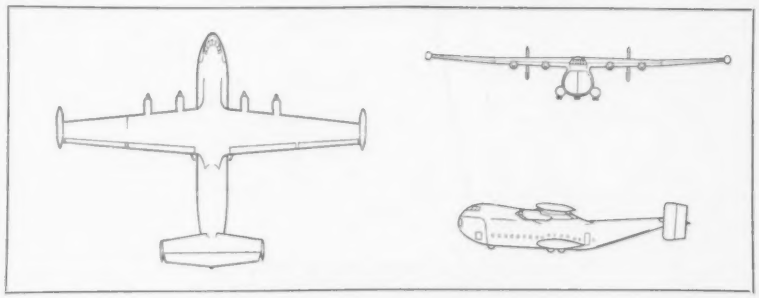
Crew
Four on flight deck.

Accommodation
Various payloads can be carried, for example, 75 parachutists and 3 despatchers; 92 stretcher cases and 9 medical attendants; 108 troops; 6 fully-laden Ferret scout cars; 2 Prestwick Pioneers or Bristol Sycamores, etc.

Dimensions
Span: 166 ft. 0 in.
Length: 124 ft.
Height: 31 ft.
Wing area: 2,916 sq. ft.

Weights
Max. take-off: 175,000 lb.
Empty (operational): 89,000 lb.

Performance
Max. speed: —.
Cruising speed: 306 knots at 25,000 ft.
Initial climb: —.
Service ceiling: 33,000 ft.
Balanced field length: 1,450 yd.
Range: 1,300 n.m. with 58,000 lb. payload. With full fuel, range is 4,400 n.m.



Bristol 200

ONE of the proposals which B.E.A. considered, earlier this year, to meet their short-haul turbojet requirement was the Bristol 200. With a weight of 120,000 lb. and cruising at 600 m.p.h. it would carry a 21,000-lb. payload over a stage of 1,800 miles. If produced as a result of American and other interest, it would be sponsored by a joint Bristol-Hawker Siddeley company.

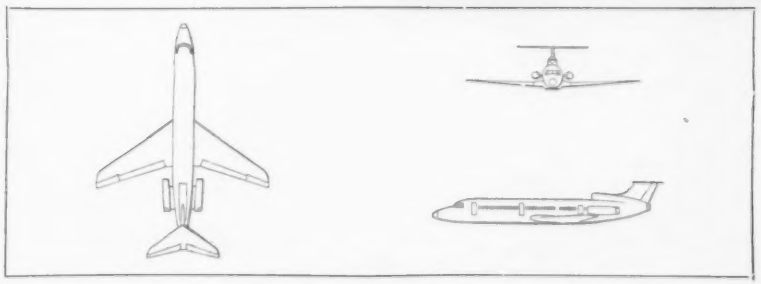
Powerplant
Possibly three Curtiss-Wright Zephyrs (U.S. derivation of Bristol Olympus).

Accommodation
90.

Dimensions
Span: 91 ft.
Length: 121 ft. 6 in.
Height: Not available.
Wing area: Not available.

Weights
Max. gross: 120,000 lb.
Capacity payload: 21,000 lb.

Performance
Max. speed approx. 520 knots
Range: 1,475 n.m. with capacity payload.



Short S.C.1

CONCEIVED as a "flat-riser" VTOL research aircraft to explore transition problems from vertical to forward flight and vice versa, the Short S.C.1 has four R.B.108 turbojets mounted vertically in the fuselage, and a fifth at 30° in the tail. Control in hovering flight is by air nozzles at the wing and fuselage tips, while the vertical engines have a limited degree of swivel to aid transition. First conventional flight was on April 2, 1957.

Powerplant
Five 2,010-lb. Rolls-Royce R.B.108, four mounted vertically and the fifth at 30 degrees to the horizontal.

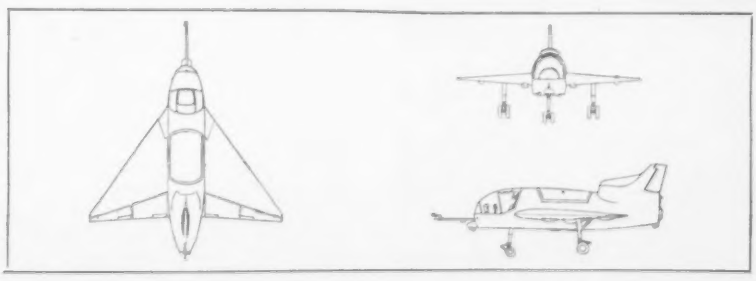
Crew
Pilot.

Armament
Nil.

Dimensions
Span: 23 ft. 6 in.
Length (including nose probe): 29 ft. 10 in.
Fuselage length: 24 ft. 5 in.
Height: 10 ft. 8 in.
Wing area: Not available.

Weights
Loaded: approximately 8,000 lb.

Performance
Not released for publication.



Research Aircraft, Prototypes and Projects . . . .

Hunting H.107

A PROJECTED small turbojet transport for short-haul operation, the Hunting H.107 follows the current trend in having its two powerplants mounted externally at the rear of the fuselage. This layout enables the 20° swept wing to be kept absolutely clean with consequent benefits to the performance.

The engine installation is such that the rotating assemblies are behind the rear pressure bulkhead, which reduces cabin noise to a minimum and helps to eliminate the sonic fatigue problem. By locating the powerplant pods far back on the fuselage, they are brought closer together and thus yet another advantage — improved asymmetric power characteristics—is obtained. They are mounted high up to reduce the likelihood of foreign bodies being thrown up into the air intakes.

Another feature of the H.107 design is the attention that has been paid to the fuselage nose so as to give the maximum panoramic view to the crew. In point of fact, the windscreen has been designed to meet, as near as possible, the latest American requirements for cockpit visibility.

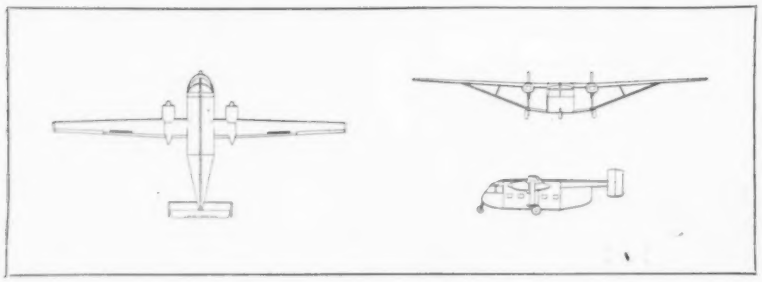
Structurally the aircraft is orthodox and simple. So far it has reached the advanced design study stage and a mock-up is being built at Luton. Production aircraft would have a first cost of around £250,000.

Powerplant
Two 4,850-lb.s.t. Bristol Orpheus 810 turbojets.
Crew
Two.
Accommodation
40 first-class passengers; or 44 tourist.
Max. coach seating: 48.
Total freight and baggage capacity: 163 cu. ft.
Dimensions
Span: 80 ft.
Length: 77 ft. 9 in.
Height: 24 ft.
Wing area: 800 sq. ft.
Weights
Max. take-off: 41,500 lb.
Empty (operational): 20,670 lb.
Performance
Cruising speed: 400 knots at 36,000 ft.
Approach speed: 105 knots at max. landing wt
Balanced field length: 4,800 ft. at I.S.A. sea level.
Range (still air): 2,000 n.m. max. fuel no reserves with 3,600-lb. payload.
Range with max. payload, 950 n.m., no reserves, still air.

Miles HDM-106

THE Miles HDM-106 project is based on the well-known Hurel-Dubois very high aspect ratio wing and is a development of the HDM-105 experimental aircraft demonstrated at Farnborough last year. In point of fact the 106 has a similar wing—structurally and aerodynamically—to the 105. A new all-metal fuselage has been designed for it, however, giving a much greater capacity and accommodation for up to 17 passengers. The type is intended as a light transport for operation from restricted and unprepared airstrips where the excellent take-off and landing characteristics of the aircraft can be used to full advantage.

Particular attention has been paid in the design to engine-out performance, especially in tropical conditions at altitudes up to 8,000 ft. At present a mock-up of the 106 is being built at Shoreham.



Powerplant
Two 340-b.h.p. Lycoming G50-480-B.
Crew
One.
Accommodation
15-17 passengers.
Dimensions
Span: 75 ft. 4 in.
Length: 37 ft. 10 in.
Height: 11 ft. 5 in.
Wing area: 279 sq. ft.
Weights
Max. take-off: 8,000 lb.
Empty (operational): 4,261 lb.
Performance
Max. speed: 163 m.p.h. at s.l.
Cruising speed: 149 m.p.h. at 5,000 ft.
Initial climb: 1,279 ft./min.
Service ceiling: 25,000 ft.
Take-off to 50 ft.: 444 yd.
Range: 780 miles with 2,400-lb payload.

Short PD.18 Britannic

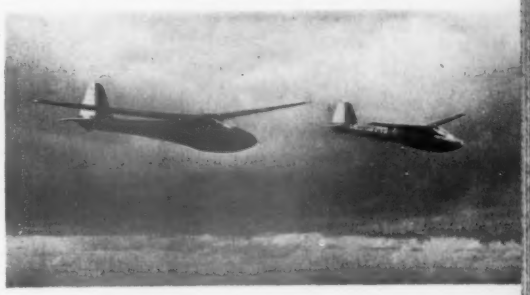
THE Short Britannic is a design study submitted by Short Brothers and Harland, Ltd., to the Ministry of Supply for a new turboprop heavy freighter utilizing Bristol Britannia components. The project has been designed primarily for transport of heavy military freight, but Shorts have also examined its performance as a civil freight/passenger transport.

The Britannic is virtually a Bristol Britannia with a new fuselage half as big again. In its initial form it is designed around four Bristol Proteus 765 engines, but advanced versions would use a more powerful engine such as the Proteus IV or the Rolls-Royce Tyne Stage I or II. Standard Britannia powerplant (in the Proteus versions), fuel system, controls, flight-deck installations, undercarriage and tail unit are used. The wing also is largely standard, but would be mounted high on the fuselage and would need minor modification to cope with higher landing weights. The undercarriage would retract into fairings at the sides of the fuselage.

The new fuselage is fitted with a low-level floor and has parachuting facilities and a large rear loading ramp. Volume and cross-section are greater than in the Britannia and the overall dimensions of the freight hold are 80 ft. by 12 ft. by 12 ft.

Initially, the PD.18 would have approximately the same take-off weight as the Britannia 310 series (180,000 lb.), but this could be increased to over 200,000 lb. The aircraft would carry a payload of about 30 tons over a range of 900 nautical miles and the optimum cruising speeds would be between 300 and 350 knots.

EoN Olympia Series IV



OLYMPIA 419

Crew
Pilot.

Dimensions
Span: 62 ft.
Length: 26 ft.
Wing area: 186 sq. ft.

Weights and Loading
Empty: 606 lb.
Loaded: 880 lb.
Wing loading: 4.5 lb./sq. ft.

Performance
Gliding angle: 1 : 38.

OLYMPIA 415

Crew
Pilot.

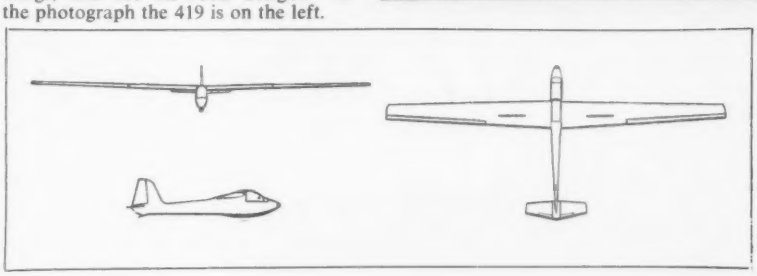
Dimensions
Span: 49 ft. 2 in.
Length: 24 ft. 6 in.
Wing area: 161 sq. ft.

Weights and Loading
Empty: 550 lb.
Loaded: 820 lb.
Wing loading: 5 lb./sq. ft.

Performance
Gliding angle: 1 : 35.

THE Series IV Olympias have been developed by Elliotts of Newbury, Ltd., from the original pre-War Olympia, via several experimental designs.

Both the 419 and the 415 were built for the 1958 World Gliding Championships, the former especially distinguishing itself in the unrestricted class. They are basically similar, with laminar-flow wings, and are all-wood designs. In the photograph the 419 is on the left.



Slingsby Swallow

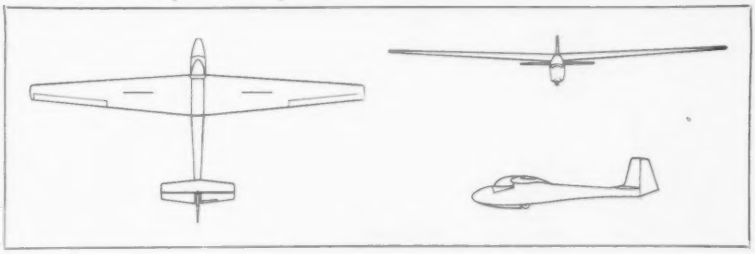
Crew
Pilot.

Dimensions
Span: 43 ft. 3½ in.
Length: 23 ft. 8 in.
Height: 5 ft. 2 in.
Gross wing area: 145.9 sq. ft.

Weights
Empty: 431 lb.
Max. loaded: 700 lb.

Performance
Designed manoeuvring speed: 75.2 knots.
Aero-tow speed: 75.2 knots.
Winch launch: 70 knots.
Stalling speed at 1 g: 33.6 knots.

THE Swallow, or Type 45, is the latest of the well-known Slingsby sailplanes. It is a small, high-performance single-seater, designed to be produced at low price. It is not primarily intended for training, but will in fact serve that purpose. Its price, complete but without instruments, is £750; a kit of parts costs £450. The tail unit consists of modified Skylark 2 components.



Slingsby T.42B Eagle

Crew
Two.

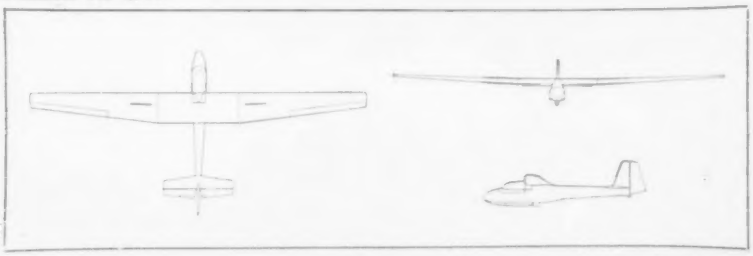
Dimensions
Span: 58 ft. 2½ in.
Length: 27 ft. 8½ in.
Height: 6 ft. 1½ in.
Wing area: 229 sq. ft.

Weights
Empty: 820 lb.
Loaded: 1,320 lb.

Performance
Max. speed: 146 m.p.h.
Sinking speed: 2 ft./sec. at 48.5 m.p.h.

IN addition to the well-known Sky and Skylark single-seat high-performance sailplanes, the Slingsby company produces the two-seater known as the Eagle, which, in various forms, is in wide service with clubs and private owners.

It is a shoulder-wing aircraft made from spruce, birch and gaboon plywood. The complete aircraft, less instruments, costs £1,650, and the kit of parts is available for £915.

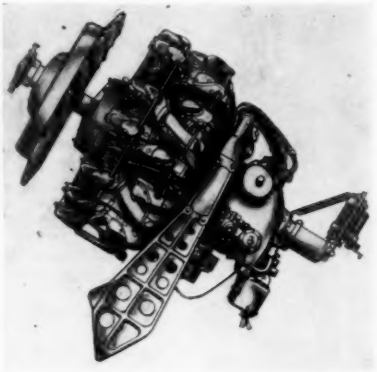


British Aero-Engines . . . .

Alvis Leonides Major Mk.155

Piston engine (helicopter powerplant): 14 air-cooled cylinders in two banks; push-rod operated valves; single-stage single-speed supercharger.

EFFECTIVELY a 14-cylinder derivative of the nine-cylinder Alvis Leonides, the Leonides Major is one of the very few new piston engines developed after the War. It has been used primarily for the Westland Whirlwind helicopter, in de-rated form because of the limited power which the S-55 transmission can take. In aeroplane form, as fitted to the first Handley Page Heralds, the Leonides Major develops 885 b.h.p. at take-off.

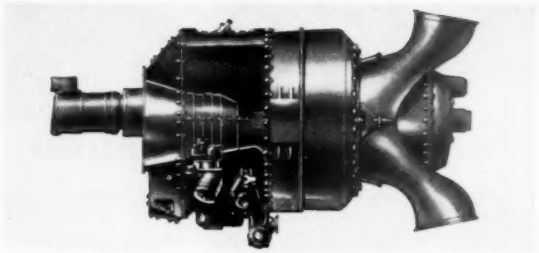


Fuel grade, 100/130; bore, 4.8 in.; stroke, 4.41 in.; swept volume, 1,118 cu. in.; compression ratio, 6.8 : 1; length, 54.9 in.; width, 38.9 in.; height, 38.9 in.; dry weight, 1,110 lb.; take-off sea-level performance, 770 b.h.p., 2,900 r.p.m.; max. continuous performance (6,750 ft.), 705 b.h.p., 2,900 r.p.m.; fuel consumption, 38.0 g.p.h.; oil consumption, 8 pt./hr.

Armstrong Siddeley P.181

Shaft turbine: two-stage axial compressor with final centrifugal stage (2 + 1); annular reverse-flow combustion chamber; two-stage turbine; single-stage free power turbine.

NOW being built by Armstrong Siddeley, the P.181 is a 1,000-s.h.p. shaft-turbine engine for helicopters. A turboprop version, the P.182, is also planned. The mixed axial and centrifugal compressor is a good compromise between the efficiency of the one type and the inherent robustness of the other. The annular reverse-flow combustion chamber envelops the turbine casing. These features result in a very short and compact engine.

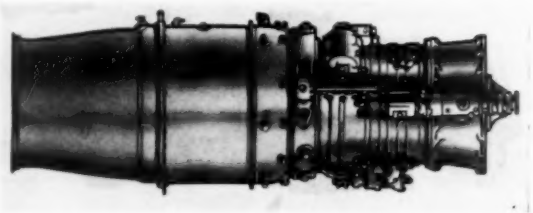


Pressure ratio, 5.9 : 1; air mass flow, 12.5 lb./sec.; take-off sea-level performance, 200-lb. thrust, 1,020 s.h.p., 14,600 power turbine r.p.m.; s.f.c., 0.71 lb./s.h.p./hr.; max. continuous performance, 182-lb. thrust, 930 e.h.p., 14,600 power turbine r.p.m.; s.f.c., 0.72 lb./s.h.p./hr.; length, 48.53 in.; width, 27.4 in.; weight, 540 lb. (approx.).

Armstrong Siddeley Viper A.S.V.11

Turbojet: seven-stage axial compressor; annular combustion chamber; single-stage turbine.

FIRST produced to power the Jindivik target drone, Vipers are now produced by Armstrong Siddeley for several types of piloted aircraft. The 1,750-lb. thrust A.S.V.8 is standard power unit for the Hunting Jet Provost trainer; the A.S.V.9 of 1,900-lb. thrust is used in the Bell X-14 VTOL aeroplane; the 2,000-lb. thrust A.S.V.10 and 2,460-lb. A.S.V.11 have a compressor of new mechanical design. The A.S.V.100 or R.7 engine built by Dassault in France is a scaled-up Viper of 3,000-lb. thrust.

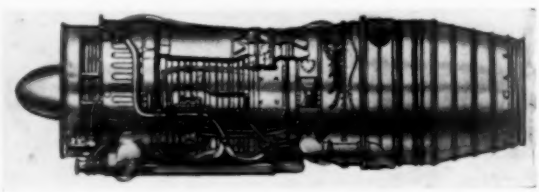


Pressure ratio, 3.9 : 1; air mass flow, 42.0 lb./sec.; take-off sea-level performance, 2,460-lb. thrust, 13,400 r.p.m.; s.f.c., 1.11 lb./lb./hr.; max. continuous performance, 2,020-lb. thrust, 12,700 r.p.m.; s.f.c., 1.10 lb./lb./hr.; length, 47.77 in.; length with ex. cone, 69.17 in.; width, 24.3 in.; dry weight, 500 lb.; power/weight ratio, 4.92 : 1.

Armstrong Siddeley Sapphire A.S.Sa.7

Turbojet: 13-stage axial compressor; annular combustion chamber; two-stage turbine.

SAPPHIRES have been widely used in British military aeroplanes such as the Gloster Javelin, Handley Page Victor and some Hawker Hunters. One of the first large British axial-compressor turbojets to go into production the Sapphire has also been built in large numbers in America as the Curtiss-Wright J65. The total of Sapphires produced is about 10,000. The Sapphire A.S.Sa.9, which did not go into production, was rated at 12,700-lb. thrust.

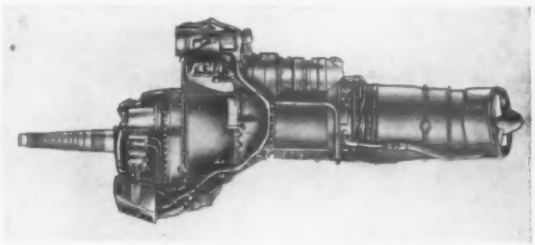


Take-off sea-level performance, 11,000-lb. thrust, 8,600 r.p.m.; s.f.c., 0.88 lb./lb./hr.; max. continuous performance, 9,600-lb. thrust, 8,200 r.p.m.; s.f.c., 0.845 lb./lb./hr.; length, 107.2 in.; length with ex. cone, 130.7 in.; width, 37.4 in.; dry weight, 3,030 lb.; power/weight ratio, 3.63 : 1.

Armstrong Siddeley Double Mamba A.S.M.D.8

Twin-turboprop : 11-stage axial compressors ; annular combustion chambers ; three-stage turbines.

SPECIALLY developed for the Fairey Gannet anti-submarine aeroplane, the Double Mamba consists of two Armstrong Siddeley Mamba turboprop engines side-by-side and driving co-axial propellers through a common gearbox. This installation allows maximum power for take-off followed by economical cruising with one Mamba shut off and its propeller blades feathered, both engines being used again for landing.

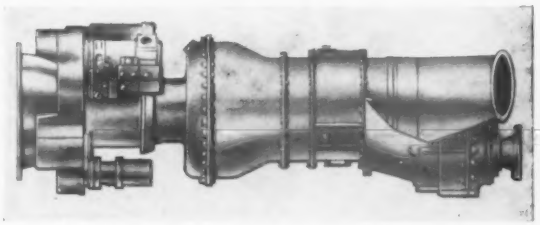


Pressure ratio, 5.85 : 1; air mass flow, 2×21.0 lb./sec.; take-off sea-level performance, 710-lb. thrust, 3,600 s.h.p., 3,875 e.h.p., 15,000 r.p.m.; s.f.c., 0.66 lb./e.h.p./hr.; max. continuous performance, 710-lb. thrust, 3,875 e.h.p., 15,000 r.p.m.; s.f.c., 0.66 lb./e.h.p./hr.; length, 84.62 in.; length with ex. cone, 103.35 in.; width, 56.55 in.; dry weight, 2,560 lb.; power/weight ratio, 1.55 : 1.

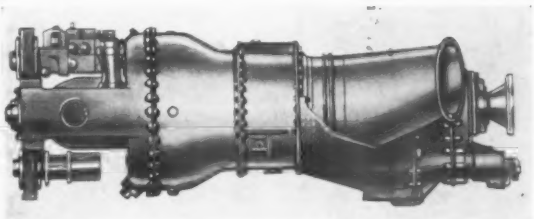
Blackburn-Turboméca A.129

Shaft turbine : axial compressor with final centrifugal stage (2 + 1) ; annular combustion chamber ; two-stage turbine ; single-stage free power turbine.

HAVING for some years developed British versions of the French Turboméca range of small gas-turbine engines, the engine division of Blackburn and General Aircraft, Ltd., is now working on a new shaft turbine which uses many standard parts. The A.129 is basically an Artouste 600 to which has been added a two-stage axial compressor ahead of the centrifugal compressor. Shaft drive is taken out at the rear through a free power turbine and a Turmo gearbox. Intended mainly as a helicopter engine, the A.129 will be developed to give 950 s.h.p., with an s.f.c. of 0.66 lb./s.h.p./hr., after turbine modifications.



Pressure ratio, 6.35 : 1; take-off sea-level performance, 840 s.h.p.; s.f.c., 0.78 lb./s.h.p./hr.; weight, 390 lb.

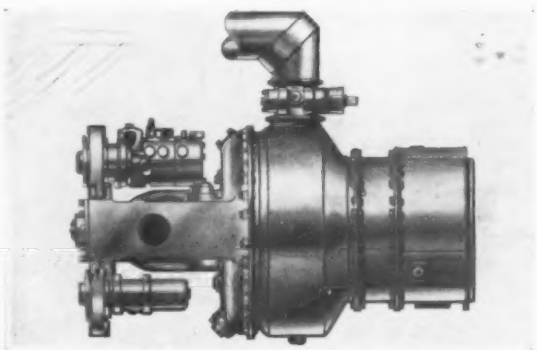


Pressure ratio, 4.12 : 1; air mass flow, 7.2 lb./sec.; take-off sea-level performance, 450 s.h.p., 35,000 r.p.m.; s.f.c., 1.05 lb./s.h.p./hr.; max. continuous performance, 400 s.h.p. 34,000 r.p.m.; s.f.c., 1.07 lb./s.h.p./hr.; length, 47.9 in. single-stage gearbox or 51.9 in. two-stage gearbox; width, 21.0 in.; dry weight, 271 lb. single-stage gearbox or 313 lb. two-stage gearbox.

Blackburn-Turboméca Turmo 600

Shaft turbine : single-stage centrifugal compressor ; annular combustion chamber ; single-stage turbine.

BRITISH version of a well-established French engine, the Turmo 600 is, in effect, a Palas turbojet with a free power turbine added. A Blackburn Turmo 600 powers the new Saunders-Roe P.531 five-seat helicopter, the great advantage of a free turbine engine being that no weighty clutch is required. Type-tested at a 1-hr. rating of 400 s.h.p., the Turmo can be operated on either wide-cut gasolene, kerosene or Diesel fuel. Rotor speed is set by a governor controlling the free turbine.



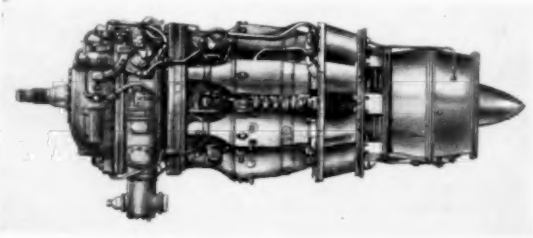
Pressure ratio, 3.88 : 1; air mass flow, 2.71 lb./sec.; take-off sea-level performance, 252 e.h.p., 35,000 r.p.m.; s.f.c., 1.23 lb./e.h.p./hr.; max. continuous performance, 231 e.h.p., 35,000 r.p.m.; s.f.c., 1.24 lb./e.h.p./hr.; length, 33.5 in.; width 17.5 in.; dry weight, 210 lb.; height, 18.6 in.

Blackburn-Turboméca Palouste 500 Bn.Pe.1

Gas generator : single-stage centrifugal compressor ; annular combustion chamber ; two-stage turbine.

TWO versions of the Blackburn Palouste are produced, one as an aircraft powerplant and the other as an air starter for gas-turbine engines. The Palouste has an oversize compressor, the air surplus to the unit's own requirements being bled off for other uses. The Fairey Ultra Light helicopter has a Palouste to provide compressed air for the rotor-tip pressure-jests. As an air starter the Palouste is either encased in an airborne pod or is mounted in a ground trolley.

British Aero Engines . . . .

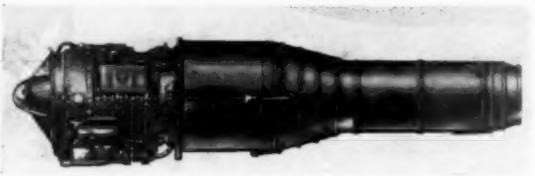


Pressure ratio, 7.2 : 1; air mass flow, 44.3 lb./sec.; take-off sea-level performance, 1,260-lb. thrust, 3,960 s.h.p., 4,445 e.h.p., 11,593 r.p.m.; s.f.c., 0.60 lb./e.h.p./hr.; max. continuous performance, 1,165-lb. thrust; 3,520 s.h.p., 10,666 r.p.m.; s.f.c., 0.60 lb./e.h.p./hr.; length with ex. cone, 100.6 in.; width, 40.1 in.; dry weight, 2,900 lb.; power/weight ratio, 1.53 : 1.

Bristol Proteus 765

Turboprop : axial compressor with final centrifugal stage (12 + 1); eight combustion chambers ; two-stage turbine and two-stage free power turbine.

A NEW range of Bristol Proteus turboprop engines, the 760 series, was announced on July 2. The Proteus 761, already in service with B.O.A.C. Bristol Britannias, has improved specific fuel consumption when cruising and develops maximum power at lower compressor r.p.m. than the 750 series engines. The Proteus 762 is similar to the 761 but has a different fuel injector, a recalibrated control unit and 5% more power at take-off. The Proteus 761 and 762 can be converted in the field to the Proteus 765 standard, giving higher power for take-off and cruise in addition to the improved specific fuel consumption.



Take-off sea-level performance, 4,850-lb. thrust; s.f.c., 1.06 lb./lb./hr.; length with ex. cone, 75.45 in.; width, 32.4 in.; dry weight, 825 lb.; power/weight ratio, 5.88 : 1.

Bristol Orpheus B.Or.3 Mk.803

Turbojet : seven-stage axial compressor ; seven cannular combustion chambers ; single-stage turbine.

ADOPTED as the power unit for NATO strike fighter aircraft, the Bristol Orpheus B.Or.3 has been fitted to the Breguet 1001 Taon, Fiat G.91, Dassault Etendard VI and Lockheed Jetstar. The Orpheus B.Or.4 is de-rated to 4,230-lb. for the Folland Gnat Trainer. Other versions are in the Gnat and Fuji T1F-2. More powerful versions of the Orpheus are the B.Or11 (5,760-lb. thrust) and the B.Or.12 (6,810-lb. thrust, 8,000 lb. with reheat) which has the very high thrust/weight ratio of 6.18 : 1. An American version is the Curtiss-Wright TJ-37.

Bristol Thor B.T.2

Ramjet for operation at high supersonic speeds : kerosene fuel ; guided weapon engine.

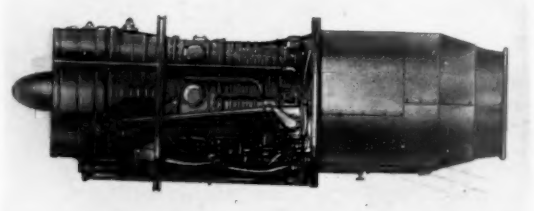
TWO Bristol Thor ramjets form the sustainer powerplant of the Bristol Bloodhound surface-to-air guided weapon, the launching being by booster rockets which accelerate the missile up to about Mach 1.5. The Thors then take over and increase the speed to nearly Mach 2.5. The Bristol BRJ.801 is a larger development of the Thor and has a diameter of 18 in. The Thor will be the first ramjet engine to go into service in this country.

Ram compression-ratio at Mach 2.5, about 15 : 1., rising to 28 : 1 at Mach 3.0; s.f.c., about 1.5 lb./lb./hr. when throttled back at 36,000 ft. and above; thrust at sea-level at Mach 3.0, about 20,000 lb.; length, 94.5 in.; diameter, 15.75 in.

Bristol Olympus B.Ol.7 Mk.201

Two-spool turbojet. Apparent layout: five-stage L.P. and seven-stage H.P. axial compressors; eight cannular combustion chambers ; single-stage H.P. turbine and single-stage L.P. turbine.

LATEST version of the Olympus, the B.Ol.7 will doubtless be the powerplant of later Avro Vulcans for the R.A.F., replacing the 16,000-lb. thrust Olympus B.Ol.6 Mk. 200 engines. A type-test rating of 17,000-lb. thrust was announced in June, 1,000 lb. higher than that of the B.Ol.6. It is claimed that the Olympus B.Ol.7 has the highest thrust/weight ratio—about 4.72:1—of type-tested engines of this power. A commercial derivative of the Olympus is the Curtiss-Wright TJ-38 Zephyr of 12,500-lb. thrust.

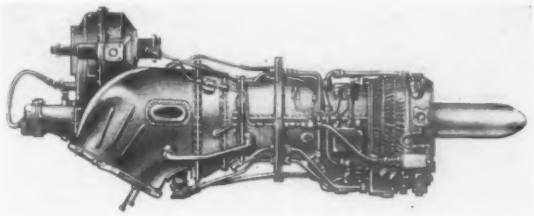


Take-off sea-level performance, 17,000-lb. thrust; length with ex. cone, 126.4 in.; width, 41.75 in.; weight, 3,600 lb. (approx.).

De Havilland Gnome D.Ge.1.

Shaft turbine : 10-stage axial compressor, variable-incidence inlet guide vanes and the first three rows of stators ; annular combustion chamber ; two-stage turbine and single-stage free power turbine.

DERIVED by de Havillands from the General Electric T58, the Gnome is an advanced design of shaft-turbine engine in the 1,000-s.h.p. class now popular for re-engining helicopters formerly fitted with piston engines. It may also be available in turboprop form. Low weight is largely a result of using a multi-stage axial compressor with high compression-ratio and this engine has the highest power/weight ratio of any shaft turbine.

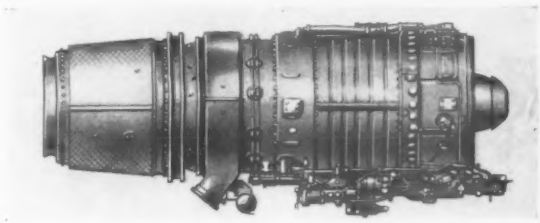


Pressure ratio, 8.0 : 1; air mass flow, 12.4 lb./sec.; take-off sea-level performance, 1,000 s.h.p., 19,500 power turbine r.p.m.; s.f.c., 0.65 lb./s.h.p./hr.; max. continuous performance, 900 s.h.p., 19,500 power turbine r.p.m., s.f.c., 0.67 lb./s.h.p./hr.; length with ex. pipe, 54.8 in.; width, 18.2 in.; weight, 275 lb. or 350 lb. with reduction gear; power/weight ratio, 2.78 : 1.

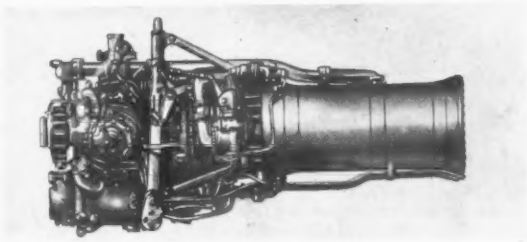
De Havilland Gyron Junior D.G.J.1

Turbojet : axial compressor ; annular combustion chamber ; (probably) two-stage turbine.

BASICALLY a supersonic turbojet, the Gyron Junior is a scaled-down derivative of the 20,000-lb. thrust de Havilland Gyron D.Gy.2. In subsonic form it is fitted to the twin-engined Blackburn NA.39 naval strike aeroplane. A more powerful version, the Gyron Junior D.G.J.10, almost certainly has a five-figure thrust, but no application of it has been revealed since cancellation of the Saunders-Roe P.1 / / interceptor.



Take-off sea-level performance, 7,000-lb. thrust; length with ex. cone, 102.9 in.; width, 41.1 in.

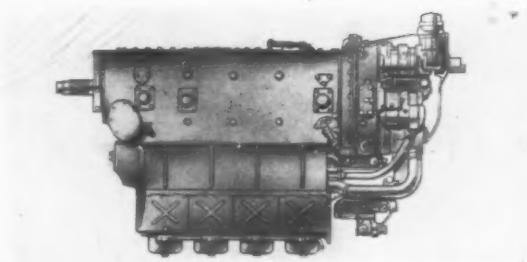


Maximum performance, 8,000 lb. thrust (approx.); length, 56.5 in.; width, 26.5 in.

De Havilland Spectre D.Spe.5

Liquid propellent rocket : one combustion chamber; hydrogen peroxide oxidant; kerosene fuel ; hydrogen peroxide coolant ; propellents supplied by turbo-pumps.

PRIMARILY intended for use in piloted aircraft, the de Havilland Spectre has been produced in several forms. The Spectre D.Spe.1, 3 and 5 are variable-thrust engines, as used in the Saunders-Roe S-R.53, and the fixed-thrust D.Spe.2 and 4 are assisted take-off units for V-bombers. Latest in the series is the Double Spectre D. Spe.D.1 which would find its most likely application in the stand-off bomb.

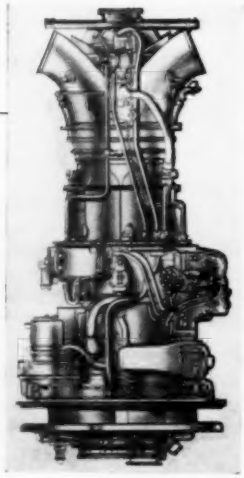


Fuel grade, 100/130; bore, 4.725 in.; stroke, 5.905 in.; swept volume, 416 cu. in.; compression ratio, 7.25 : 1; length, 56.5 in.; width, 20.0 in.; height, 34.0 in.; dry weight, 415 lb.; take-off sea-level performance, 215 b.h.p., 2,850 r.p.m.; max. continuous performance, 207 b.h.p., 2,700 r.p.m.; fuel consumption, 9.6 to 10.3 g.p.h.; oil consumption, 1.5 pt./hr.

De Havilland Gipsy Major 215

Piston engine : four air-cooled in-line (inverted) cylinders ; push-rod operated valves ; un-supercharged.

LATEST of the long line of de Havilland four-cylinder reciprocating engines, the Gipsy Major 215 has been developed for helicopter use and is the powerplant of the Saunders-Roe Skeeter. Its military designation is Gipsy Major Mk. 140. It is possible to fit an exhaust-driven supercharger to the engine if it is required to maintain full power up to 4,000 ft. under I.C.A.N. +30°C. conditions, or for operation from high-level airfields.

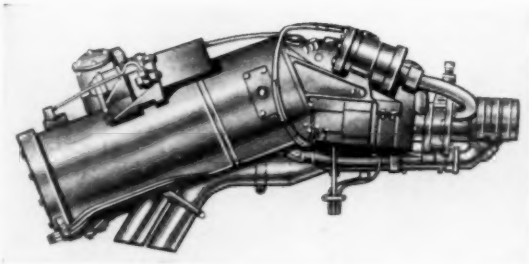


Pressure ratio, 6.37 : 1; air mass flow, 17.5lb./sec.; take-off sea-level performance, 340-lb. thrust, 1,800 s.h.p., 20,400 r.p.m.; s.f.c., 0.66 lb./s.h.p./hr.; max. continuous performance, 285-lb. thrust, 1,450 s.h.p., 19,500 r.p.m.; s.f.c., 0.70 lb./s.h.p./hr.; length, 70.0 in.; width, 33.5 in.; dry weight, 865 lb.; power/weight ratio, 2.08 : 1.

Napier Gazelle N.Ga.3

Shaft turbine : 11-stage axial compressor ; six combustion chambers ; two-stage turbine ; single-stage free power turbine.

TWO British helicopters are powered by the Napier Gazelle, the Westland Wessex and the new twin-engined, tandem-rotor Bristol 192. The Gazelle is thus exclusively a helicopter engine so far. Following the same type of layout, the Gazelle Junior has been designed for the 1,000-s.h.p. power bracket of helicopter engines. It will be offered in coupled form as a replacement for piston-engine powerplants.



No information is released on this latest version of the Scorpion except the length, 32 in., and the width, 23 in.

Napier Double Scorpion N.Sc.D.1

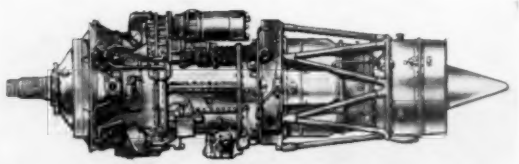
Liquid propellent rocket : two combustion chambers ; hydrogen peroxide oxidant ; kerosene fuel ; hydrogen peroxide coolant ; propellent supplied by turbo-pumps.

THE Napier Scorpion has appeared with both single and double combustion chambers. A Double Scorpion helped a Canberra to set up a height record of 70,310 ft. in August last year. In this form the rocket engine will doubtless be fitted to the English Electric P.1B interceptor. Other applications of the Scorpion are not known, but it seems likely that it might be used for certain missiles.

Napier Eland N.El.6

Turboprop : 10-stage axial compressor ; six combustion chambers ; three-stage turbine.

ELANDS are fitted to the Westland Westminster and Fairey Rotodyne twin-engined helicopters, and to the Canadair 540(CL-66) transport aircraft developed from the Napier Eland-Convair test-bed. In the case of the Rotodyne, the Elands drive propellers for forward flight; in vertical flight, most of the power is transmitted through hydraulic clutches to nine-stage auxiliary compressors which feed air to the rotor tip-jets. The Westminster has shaft drive from the Elands to the rotor through the clutches and a gearbox.



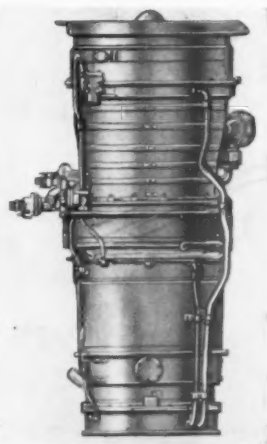
Pressure ratio, 7.0 : 1; air mass flow, 31.0 lb./sec.; take-off sea-level performance, 700-lb. thrust, 3,230 s.h.p., 3,500 e.h.p., 12,500 r.p.m.; s.f.c., 0.6 lb./e.h.p./hr.; max. continuous performance, 625-lb. thrust; 2,670 s.h.p., 12,000 r.p.m.; s.f.c., 0.615 lb./e.h.p./hr.; length with ex. cone, 122.25 in.; width, 36.0 in.; dry weight, 1,750 lb.; power/weight ratio, 2.0 : 1.

Rolls-Royce R.B.108

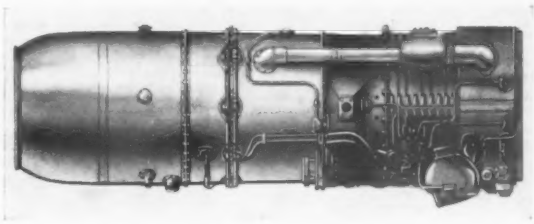
Turbojet : axial compressor ; (probably) annular combustion chamber ; (probably) single-stage turbine.

ALTHOUGH there may well be other VTOL projects pending, the R.B.108 has so far been used only in the Short S.C.1, where four engines are mounted vertically in pairs on trunnions for VTOL flight and a fifth is mounted at 30° to the horizontal for forward flight. Possible future applications for the R.B.108 are as the "lifting" engines of a VTOL strike aircraft, whether "built-in" to an airframe having other engines for forward flight or as the power units for lifting platforms used to launch an otherwise "normal" aeroplane.

No information is released on this special engine for VTOL aircraft, except that it has a thrust rating of 2,010 lb. The R.B.108 is a successor to the Soar and similarly has a very high thrust/weight ratio.



British Aero Engines . . . .

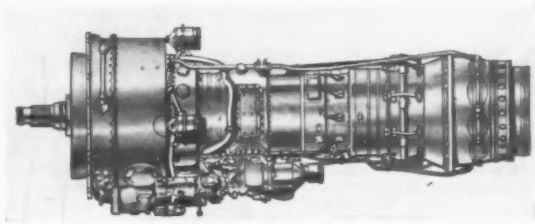


Take-off sea-level performance, 18,500-lb. thrust (R.Co.15); 17,500-lb. thrust (R.Co.12); 17,250-lb. thrust (R.Co.11); 16,500-lb. thrust (R.Co.10); length with ex. cone, 132.5 in.; width, 42.0 in. Thrusts for civil Conways (R. Co. 10, 12 and 15) are guaranteed minima.

Rolls-Royce Conway R.Co.15

Two-spool by-pass turbojet: multi-stage L.P. and H.P. axial compressors; cannular combustion system; H.P. and L.P. turbines.

FIRST production by-pass turbojet engine in the World, the Rolls-Royce Conway has both commercial and military uses. Most powerful of the range is the R.Co.15, which has just twice the power of the original R.Co.2. Conways are specified for the Vickers VC-10, Boeing 707 and Douglas DC-8. Sole military application so far is the Handley Page Victor B.2 (R.Co.11—illustrated). Another by-pass design is the R.B.141 engine of 12,000-lb. thrust for the D.H.121 jet transport ordered by B.E.A.



Pressure ratio, 13.0 : 1; take-off sea-level performance, 1,290-lb. thrust, 5,030 s.h.p., 5,525 e.h.p.; s.f.c., 0.48 lb./e.h.p./hr.; length of engine, 100.25 in.; width, 40.5 in.; cruise s.f.c., 0·388 lb./e.h.p./hr. The R.Ty.12 has 5,090 s.h.p. and 1,075 lb. thrust at take-off.

Rolls-Royce Tyne R.Ty.11

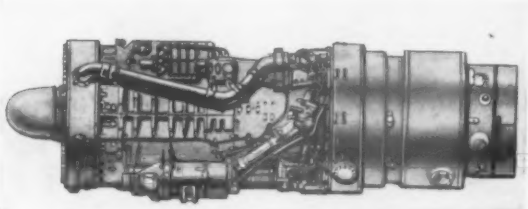
Twin spool turboprop: multi-stage L.P. and H.P. axial compressors; cannular combustion system: single-stage H.P. and three-stage L.P. turbines.

FIRST of the new generation of high-compression twin-spool turboprop engines, the Rolls-Royce Tyne offers unusually good cruising fuel economy. Powerplant for the Vickers Vanguard and Canadair CL-44, the Tyne is also specified for several projects including the Armstrong Whitworth A.W.651 and A.W.661, the Blackburn B.107 and the Short P.D.18 Britannic. An Ambassador fitted with two Tynes is soon to fly and will be put into scheduled use to gain operating experience.

Rolls-Royce Avon R.A.29

Turbojet: 16-stage axial compressor; eight cannular combustion chambers; three-stag turbine.

COMMERCIAL version of an extremely successful military turbojet, the R.A.29 Rolls-Royce Avon is the most advanced design of the series, having an additional (zero) compressor stage and a third stage in the turbine. Economy and long life between overhauls have been achieved by designing for low flame-temperatures. This has resulted in recent A.R.B. authorization of a 1,000-hr. period between overhauls. The R.A.29 is used in the de Havilland Comet 4 and the Sud-Aviation Caravelle.

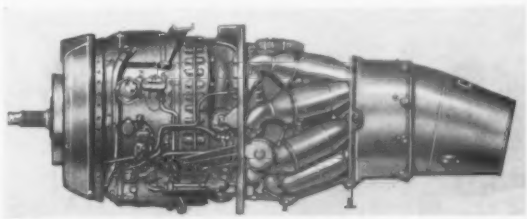


Take-off sea-level performance, 10,500-lb. thrust, 8,000 r.p.m.; s.f.c., 0.775 lb./lb./hr.; length with ex. cone, 124.8 in.; width, 41.5 in.; dry weight, 3,326 lb.; power/weight ratio, 3.16 : 1. The R.A.29/5 will have a thrust of 13,300 lb.

Rolls-Royce Dart R.Da. 7/2

Turboprop; two-stage centrifugal compressor; seven combustion chambers; three-stage turbine.

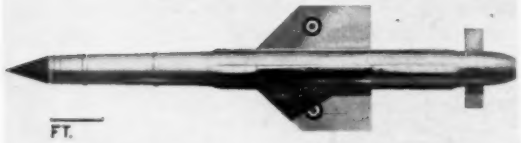
WIDE application of the Rolls-Royce Dart is a testimony to its reliability and excellent performance. The Dart R.Da.7 series are fitted to the Vickers Viscount 806 (R.Da.7 Mk. 520), Viscount 810 (R.Da.7/1 Mk. 525), Armstrong Whitworth A.W.650 Argosy (R.Da.7/2 Mk. 526), Handley Page Dart Herald (R.Da.7/2 Mk. 527), Grumman Gulfstream (R.Da.7/2 Mk. 529) and Fokker F.27 Friendship (R.Da.7/1 Mk. 528). Latest Dart is the R.Da. 11 of 2,350 e.h.p., which has a pressure ratio of 6.35 : 1 and an air-mass flow of 25.5 lb./sec.



Pressure ratio, 5.75 : 1; air mass flow, 22.0 lb./sec.; take-off sea-level performance, 505-lb. thrust, 1,910 s.h.p., 2,105 e.h.p., 15,000 r.p.m.; s.f.c., 0.66 lb./e.h.p./hr.; max. continuous performance, 445-lb. thrust; 1,920 e.h.p.; 14,400 r.p.m.; s.f.c., 0.745 lb./e.h.p./hr.; length, 97.6 in.; width, 37.9 in.; dry weight, 1,250 lb.; power/weight ratio, 1.72 : 1.

Britain's Guided Weapons

DE HAVILLAND FIRESTREAK

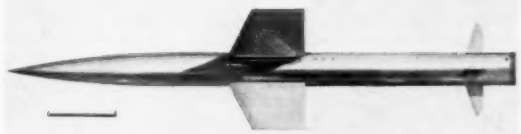


AN AIR-TO-AIR weapon in production for the R.A.F., Firestreak will form the standard armament of the English Electric P.1B., the Javelin, and the Sea Vixen. It has an infra-red homing head developed by the de Havilland team and is powered by a single solid rocket motor. Control of the missile is through the medium of moving tail fins. No performance details are available; weight has been given as 300 lb.

Technical Data
Length, 10.0 ft.; max. dia., 0.75 ft.; wing span, 2.5 ft.; fin span, 1.55 ft.

NOTE—de Havilland Propellers are also responsible for Britain's 2,000 mile L.R.B.M., no details of which have been released. Latest news of this missile will be found elsewhere.

FAIREY FIREFLASH



USED FOR operational training the Fireflash air-to-air missile has been installed on Meteor, Hunter and Swift aircraft of the R.A.F. It is powered by two external solid rocket motors which separate after firing. The missile has a proximity fuse and is a beam rider using equipment developed by Faireys and E. K. Cole. It is controlled by pneumatically operated all-moving rear control surfaces. Fireflash was the first British guided weapon to pass official acceptance tests; its speed has been given as M=2.0.

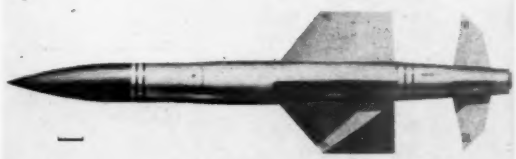
Technical Data
Length, 7.4 ft. (9.32 ft. with rocket motors on); max. dia., 0.46 ft.; wing span, 2.32 ft.; fin span, 1.54 ft.

BRISTOL BLOODHOUND

IN PRODUCTION for use by the R.A.F. as a surface-to-air anti-aircraft defence weapons system the Bloodhound uses a semi-active homing system developed by the Ferranti company; control is by the forward all-moving surfaces. Power is provided by two Bristol Thor ramjet engines, but for the initial launching phase four wrap-round solid boost rocket motors are used. Details of Bloodhound's performance characteristics have not been revealed, but it is said to have a speed at target height of Mach 2.0-2.5. The missile is launched from a transporter trolley.

Technical Data
Length, 22.0 ft.; max. dia., 1.75 ft.; wing span, 9.2 ft.; fin span, 5.0 ft.; boost length, 12.0 ft.

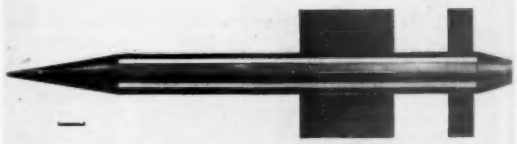
ENGLISH ELECTRIC THUNDERBIRD



ORIGINALLY INTENDED for use by the Army as a surface-to-air anti-aircraft missile, Thunderbird is also in production for the R.A.F. It uses a semi-active homing system developed by the Marconi company and is controlled by moving tail fins. The main sustainer motor is a single large solid rocket unit but this is boosted during the launching phase by four smaller wrap-round solid rocket motors. Performance details have not so far been released. Thunderbird is fired from a zero-length launcher.

Technical Data
Length, 18.88 ft.; max. dia., 1.73 ft.; wing span, 5.5 ft.; fin span, 5.25 ft.; boost length, 12.0 ft.

ARMSTRONG WHITWORTH SEASLUG



IN PRODUCTION for the Royal Navy as a shipborne surface-to-air anti-aircraft missile, Seaslug has a guidance system developed by the General Electric company and is controlled by hydraulically operated moving tail fins. A single large solid rocket motor forms the main sustainer unit and boost for launching is provided by four wrap-round solid rockets. In the most recent version of Seaslug these boosters are four single units in place of the earlier four triple units. No performance details are available. Seaslug will be launched from special gyro-stabilized platforms.

Technical Data
Length, 20.0 ft.; max. dia., 1.5 ft.; wing span, 4.75 ft.; fin span, 5.25 ft.; boost length, 12 ft. (These figures have been estimated.)

SHORT SXA-5

THE SXA-5 is a test-vehicle for a small surface-to-air shipborne weapon for the Royal Navy that is being developed by Short Brothers and Harland under a Ministry of Supply contract. This test vehicle was first shown at the S.B.A.C. display last year, but at that time it was not related specifically to a naval specification. No details of the weapon are available; it is undoubtedly powered by a single solid rocket and the general arrangement of the missile with flare casings on the fin tips suggests that a command guidance system is used.

Technical Data
Length, 6.43 ft.; max. dia., 0.79 ft.; wing span, 2.58 ft.; fin span, 2.58 ft.

AVRO STAND-OFF BOMB

DESIGNED SPECIFICALLY for use with the Vulcan and Victor bombers the stand-off bomb developed by A. V. Roe is intended to increase the striking capacity of the V-bomber force and enable it to launch its offensive weapons outside the range of defensive surface-to-air missiles. No details of the stand-off bomb have been released. It has been stated that initially it will be rocket powered and an engine that has been mentioned in this context is the de Havilland Spectre. The weapon is about 35 ft. long and 5 ft. in diameter. In addition to its rear underside fin and swept vertical fin and rudder, it has a small delta foreplane and a larger low aspect ratio delta rear wing.

THE STATIC EXHIBITION—

a Guide to the Indoor and Outside Stands

On this and the following 11 *pages will be found a guide to the exhibits—other than complete aircraft, aero-engines and guided missiles which are described elsewhere—on the stands in the static exhibitions at Farnborough. This year there are some* 330 *exhibitors who are listed alphabetically with the appropriate stand numbers; the initials O.D.S. indicate the outside display sites. A directory of non-exhibitors follows this section.*

Accles and Pollock, Ltd. (158). Manufacturers of working platforms, freight loaders and seamless aircraft tubes.

Acton Bolt, Ltd. (115). Range of standard high-tensile aircraft bolts; metal screws; tools, and method of manufacture of cold-formed high-tensile bolts.

Aero Controls, Ltd. (190). New items are ACflex pipe couplings; long-reach toggle fasteners, and unit-construction universal joints. Range of A.S. and A.G.S. standard parts; toggle and shear-type fasteners, and universal joints.

Aeroplastics, Ltd. (216). Plastic mouldings for use in aircraft and guided missiles; Aeropak packaging material, and pre-impregnated reinforced plastics.

Airmed, Ltd. (126). New products include the Airlite lightweight crew headset with a boom-mounted microphone; oxygen masks with miniature regulators and toggle-harness suspension; headsets for special applications. Range of civil and military oxygen masks.

The Airscrew Co. and Jicwood, Ltd. (174). New items include lightweight axial- and centrifugal-flow fans, particularly for helicopter applications; new range of high-efficiency single-stage axial units, and low-volume medium-pressure blowers.

Airtech, Ltd. (O.D.S. 11). Aircon air transportable containers displayed with Standard Telephones and Cables, Ltd.; encapsulated electronics components; drone pilotless-aircraft control equipment.

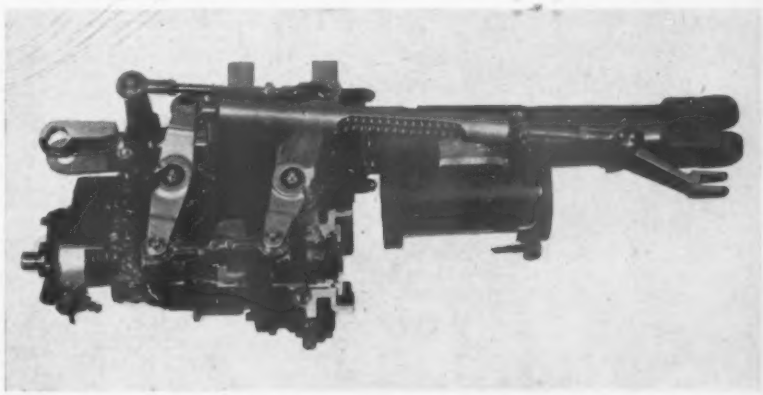
Stainless steel flexible pipes manufactured by The British Refrasil Co., Ltd. The pipes are produced by a new process which permits a large variety of volute profiles to be made over a range of diameters.

Aircraft Materials, Ltd. (257). Latest additions to the Pop and Imex ranges of rivets; parachute, ejector-seat and helicopter rescue-harness fittings; supply-dropping equipment including parachute de-reefing devices.

Aircraft Research Association, Ltd. (125). Model of the A.R.A. wind-tunnel site; model of the Saro P.177 as tested in the transonic tunnel; a 1/12th scale model of the transonic tunnel working-section.

Right, a Rotheswan Aerojack produced by Brown Brothers (Aircraft), Ltd., for lifting heavy aircraft. The standard range consists of jacks of 3- to 50-ton capacity.

Below, a typical Boulton Paul power control unit, incorporating a swash-plate pump.



Air Trainers Link, Ltd. (206). A model of the B.E.A. flight-simulator unit at Heston and a wall display illustrating the economics of the use of synthetic flight equipment.

Albright and Wilson, Ltd. (199). Producers of Kanigen plate, a new chemical nickel-phosphorus plating process.

Amalgamated Wireless (Australasia), Ltd. (224). See Marconi's Wireless Telegraph Co., Ltd.

B. Attewell and Sons, Ltd. (139). R.C.A. laminated aluminium; Perspex aircraft tableware and aircraft plastics components.

Auster Aircraft, Ltd. (260). Illuminated photographs of some of the company's products including Agricola and Workmaster.

Automotive Products, Co., Ltd. (42). Purolator filters for lubricating oil, fuel and hydraulic systems; Lockheed Avery oil replenishing and self-sealing couplings; hoses for all pressures and fluids.

Avery-Hardoll, Ltd. (250). Automatic bottom-loading equipment for aircraft refuellers; high-level shut-off valves for fuel storage tanks, refuelling couplings; 4-in. hydrant pit; bulkmeters for hydrant dispenser and test rigs.

Aviation Developments, Ltd. (6). Chobert system of riveting; Avdel self-sealing blind rivet; Pip quick-release pins; Avlok blind anchor nuts and other fasteners.

Guide to the Stands . . . .

Avica Equipment, Ltd. (269). Avica-Flex Type W metallic flexible pipe assembly; Avica-Flex precision barometric bellows for instruments; Avica-Flex bellows assemblies and Flexflyte lightweight ducting.

Bakelite, Ltd. (177). Nose-cone of English Electric Thunderbird guided missile in Bakelite polyester resins, and other guided-weapon components using alkyd and phenolic materials. Selection of polyester/glass, silicone, melamine glass-fibre, P.V.C. and polyethylene components for aircraft applications.

Baxter, Woodhouse and Taylor, Ltd. (98). Partial-pressure helmet; electrical heater components; de-icing sections; aircraft air-conditioning ducting.

B.B. Chemical Co., Ltd. (178). Bostik adhesives and sealing compounds of all types.

Bell Precision Engineering Co., Ltd. (198). Special tools for the aircraft industry.

Bell's Asbestos and Engineering, Ltd. (22). General range of Bestobell seals, mouldings and reinforced components; silicone rubber products; Flexitwist silicone rubber and glass fabric air hose; various types of ground-equipment hose.

Belling and Lee, Ltd. (16). Range of electronic components; aircraft fuses and fuseholders, including miniature plugs and sockets.

Birmetals, Ltd. (108). A selection of extruded sections in aluminium and magnesium alloys; examples of floor tread sections for aircraft.

Birmingham Aluminium Casting (1903) Co., Ltd. (161). Producers of aluminium, magnesium and zinc-base castings by the sand, gravity and pressure die-casting processes.

Blackburn and General Aircraft, Ltd. (P and O.D.S. D). Palouste auxiliary power unit for air-starting of gas-turbine engines. Electronic equipment, including a digital voltmeter; electrical power generator for airfield lighting powered by a Turmo engine.

Bloctube Controls, Ltd. (51). Linkage and pilots' console for engine controls.

Thomas Boorn and Co., Ltd. (263). New ultra-light aircraft refuelling hose; stainless steel master fuel hose; Flylite fuel hose; Flyclamp couplings; Flylex fuel hose; and an all-metal power-transmission flexible coupling.

The lightweight Airlite aircrew headset produced by Airmed Ltd., for use in the latest civil transports. The set has a boom mounted microphone and quick attachment points for an oxygen mask.

James Booth and Co., Ltd. (191). Examples of aluminium-alloy extrusions, tubes and rolled metal as supplied to the aircraft industry.

Boulton Paul Aircraft, Ltd. (J). Exhibits mainly concentrated on human and mechanical aspects of aircraft control. Latest types of power control units, including pneumatic mechanism.

B.P. Trading, Ltd. (208). Featuring B.P.-Shell service to aviation.

R. A. Brand and Co., Ltd. (240). Packages illustrating the use of universal marks of Texikoon covers for the protection of aero-engines and guided weapons, and a temporary strip-coating protective.

B.R.D. Co., Ltd. (234). Turbine blades; finished machined crankshafts; Chobham constant-velocity universal joints; industrial valves for oil, petrol and steam.

Brent Chemical Products, Ltd. (13). Flaw-detection materials for both ferrous and non-ferrous metals. Paint-removers and degreasing materials.

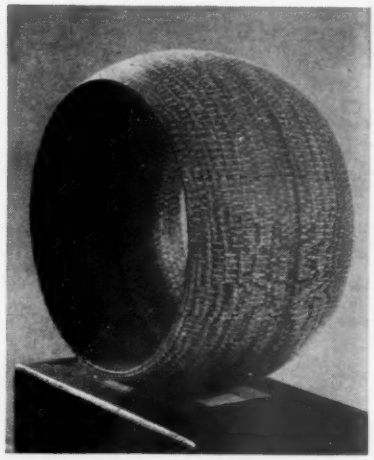
Bristol Aircraft, Ltd. (Q and 159). A 100-gal. plastic drop tank in asbestos-reinforced phenolic material. Rocket-motor tubes and high-pressure storage cases for guided missiles and aircraft. High-pressure gas-storage vessels.

British Aluminium Co., Ltd. (270). Manufacturers of aluminium and aluminium alloys in all wrought forms.

The British Ermeto Corp., Ltd. (230). Manufacturers of high-pressure couplings, shut-off and flow-control valves.

British Insulated Callender's Cables, Ltd. (172). Uni-eglas cables; P.T.F.E. equipment wires; P.T.F.E. multicore cable; irradiated polythene equipment wires; subminiature coaxial R.F. cables, and Nyvin aircraft wiring cables.

British Manufactured Bearings Co., Ltd. (85). High-precision miniature ball bearings, pressurized assembly cabinets and vacuum cabinets, assembly and handling tools.



British Manufacture and Research Co., Ltd. (218). Producers of various types of Hispano-Suiza guns; shells, fuses, belt-feed mechanisms and gun mountings.

British Messier, Ltd. (29). Nosewheel and main undercarriage units for English Electric Lightning, Folland Gnat (sectioned) and Bristol Britannia (sectioned). Small pumps and hydraulic units; relief valves and flow-dividers.

British Oxygen Engineering, Ltd. (130 and O.D.S. J). Airfield and rocket-site equipment including liquid oxygen/gaseous oxygen mobile producing plant; liquid-oxygen storage tanks, and trailer-mounted refuelling tanks with filling equipment. Oxygen-demand regulators and converters.

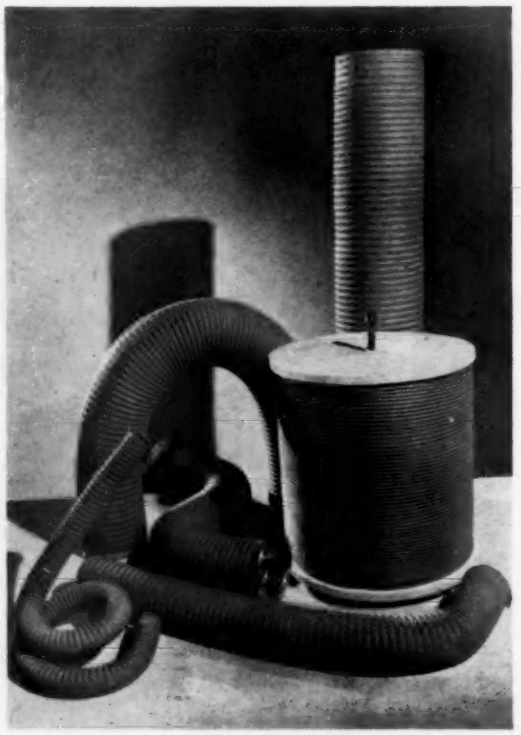
British Oxygen Gases, Ltd. (131). Development of welding in the aircraft industry including oxy-acetylene welding, inert gas and automatic Argonarc processes.

The British Refrasil Co., Ltd. (109). Examples of thermal insulating blankets; flexible pipes in stainless steel; all-welded steel honeycomb core.

The British Thomson-Houston Co., Ltd. (165). Electro-mechanical calculator which forms part of V-bomber navigation equipment; silicon rectifiers; a liquid monofuel turbo-starter; high-energy ignition units and aircraft AC and DC electric motors. Electronic equipment includes an illustration of Sting Ray target-tracking radar for ground-to-air missiles.

J. Brockhouse and Co., Ltd. (204 and O.D.S. I). Engineers' small tools, and Warwick cold-rolled sections. Airfield sweeper/sprinkler/collector and tractor-drawn sweepers used for airfield cleaning.

(*Continued on page* 331)



(Right) a spherical bearing machined from Coin Insulation Ferobestos technical plastic. This particular bearing is used in the Viscount nose-wheel.

(Left) Bestobell Flexitwist and Flexiduct silicone glass fibre hot air hoses manufactured by Bell's Asbestos and Engineering, Ltd.

Guide to the Stands . . .

(*Continued from page* 330)

Brown Bayley Steels, Ltd. (67). Semi-finished products from which aircraft components are manufactured.

Brown Brothers (Aircraft), Ltd. (166 and O.D.S. 14). Hi-Shear Pins to replace bolts and rivets carrying high shear loads; Hy-Seal pressure-sealed couplings capable of transmitting rotary motion to the inside of a hermetically sealed chamber; Oddie Stiff Nuts; a new range of power-operated ganged jacking for heavy aircraft.

David Brown Industries, Ltd. (220 and O.D.S. A). Producers of all types of gears and gear units; machine tools and castings.

S. G. Brown, Ltd. (229). Fully operational model of Master Reference Gyro Mk. 1; pneumatic aileron actuator; gyro Type 2 for radar aerial stabilizing; selection of gears; pressurized intercom amplifier, and selection of headphones.

Bryans Aeroquipment, Ltd. (280). X and Y co-ordinate plotting table; voltage controller; aircraft pressure-cabin test rigs; pitot/static system test rig; universal manometer.

Burgess Products Co., Ltd. (9). Exhaust and cabin blower silencers; air cleaners, aircraft-cabin soundproofings precision switches for aircraft and ground application, vibro tools for engraving.

Burndept, Ltd. (294). BE.29 VHF airborne transmitter/receiver; BE.226 TABLE VHF air/sea rescue beacon; a SARBE UHF air/sea rescue beacon, and a VHF G.P. beacon.

Canadian Marconi Co., Ltd. (225). See Marconi's Wireless Telegraph Co., Ltd.

Cellon, Ltd. (239). Approved dopes and finishes for civil and military aircraft, latest developments in Cellon catalyzed ester-resistant lightweight finishes; Cellon finishes for crop-spraying aircraft; heat-resistant finishes for guided missiles.

Cementation (Muffelite), Ltd. (197). Illustration of new shock and vibration test laboratory at Hersham. Barrymount anti-vibration and shock mounts.

Centrax, Ltd. (127). Machining of compressor and turbine blades, sheet-metal fabrication, pipework, gear-profiling and grinding.

Chelton (Electrostatics), Ltd. (205). Makers of insulated aerial equipment for aircraft and silent static dischargers.

Chesterfield Tube Co., Ltd. (287). Stainless-steel extrusions for gas-turbine rings.

Chloride Batteries, Ltd. (215). Demonstrations of solar-activated cells used to recharge small orthodox batteries. Two 24-V. aircraft batteries, three small unspillable portable batteries for guided missiles and water-activated batteries.

CIBA (A.R.L.) Ltd. (38). Use of Redux bonding; Aeroweb metal honeycomb; Araldite epoxy resins in aircraft construction.

Coin Insulation, Ltd. (105). Laminated synthetic resin-bonded materials built up with fabric, paper, asbestos and glass fabric fillers. Wide range of fabricated parts.

E. K. Cole, Ltd. (181 and O.D.S. O and 6). Ekco type CE 178 VHF automatic D/F equipment; single- and three-phase transistor inverters providing 400 c/s supply from a 24-V DC input.

Connolly Bros. (Curriers), Ltd. (200). Upholstery leather (Vaumol, Celstra and Luxan brands) for seating, panelling and general furnishing.

Coopers Mechanical Joints, Ltd. (40). Corrugated gaskets for high-temperature sealing; shims; washers; joints; air cleaners; light pressings and assemblies.

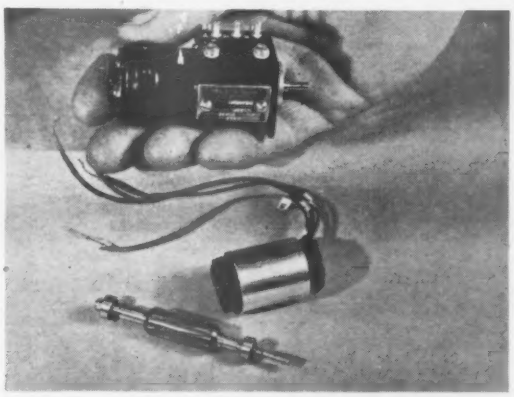
A. C. Cossor, Ltd. (235 and O.D.S. 2). CR.787 medium-range primary surveillance radar, secondary surveillance radar and C.R.D. 23 display system for A.T.C. Oscillographs for industry and telecommunications equipment.

John Curran, Ltd. (28). Colour illustrations of the company's newest thrust-measuring test stands, specially designed to accept podded turbojet powerplants, and of turboprop test stands.

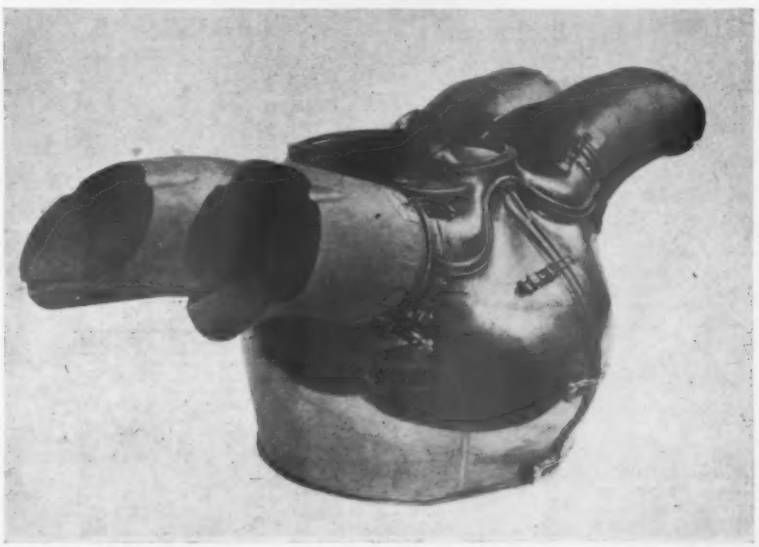
Above, the control cabin in a mobile Decca 424 airfield control radar installation which has duplicated transmitters, receivers and displays to ensure continuous operation.

Right, a Delaney Gallay anti-icing heat exchanger and shutter assembly for the Vickers Vanguard.

Below, a typical small British Thomson-Houston aircraft AC motor showing the starter and rotor separately.



Below, a helicopter engine cowling and exhaust shroud assembly made in 26 s.w.g. I.C.I. titanium by J. R. Bramah, Ltd., for Bristol Aircraft, Ltd.



Guide to the Stands . . . .

Dawe Instruments, Ltd. (81). Type 1156 250-W. Soniclean generator and Type 1405 objective noise-meter; generators; vibration meters and dynamic balancing machines.

The Decca Navigator Co., Ltd. and **Decca Radar, Ltd.** (63 and 64). A production Mk. 10 Decca Navigator receiver and latest types of Flight Log; Dectra receiver; complete Decca Integrated Airborne Navigator (DIAN) exhibit; Flight Log charts for Decca, Dectra and Doppler. New D.A.S.R.1 long-range civil surveillance radar and details of other Decca radar and control installations.

The de Havilland Enterprise and **de Havilland Propellers, Ltd.** (B and 281). Equipment used before launching of Firestreak air-to-air guided weapons. Cold-air unit for cockpit conditioning. Ventilated suit equipment. Hydraulically driven airborne radar scanner. Working model showing Beta-control for propellers. Latest propeller for Vickers Vanguard, with wide-chord blades. Gas-driven guided-missile alternator. Components in laminated epoxy resin, glass-fibre, Durestos and Sebalkyd.

Delaney Gallay, Ltd. (146 and O.D.S. 7). Vickers Vanguard anti-icing heat-exchanger and shutter assembly; Vanguard heat shroud; aluminium flux bath-brazed exhibits; and a self-contained toilet cabinet.

Desoutter Brothers, Ltd. (162). New products displayed are a pneumatic screwdriver and nutrunner, and a silent pneumatic screwdriver.

Docker Brothers (135). Surface coatings and allied materials specially suitable for the protection and interior decor of aircraft, including Dockerlight range of finishes.

Dowty Equipment, Ltd. (33), with **Dowty Equipment of Canada, Ltd.** (36), **Dowty Fuel Systems, Ltd.** (34), and **Dowty Seals, Ltd.** (35). Undercarriages developed for NA.39, Fokker Friendship and A.W.650 Argosy; fuel system and burners for the D.H. Gyron Junior; Greasfil switch containing a silicone grease to prevent entry of moisture and high-altitude freezing-up, and other switches.

Dragonair, Ltd. (258). Heaters for aircraft cabins and de-icing systems; oil-fired air heaters; heating and ventilating systems.

Dunlop Rubber Co., Ltd. (44). Exhibits include aircraft tyres, wheels, brakes and Maxaret anti-skid units for pneumatic or hydraulic operation; latest developments in thermal de-icing applications; rubber accessories; 3,000 p.s.i. air compressors; thrust-reversal rams and electromatic valves.

Dzus Fasteners Europe, Ltd. (133). Standard, self-ejecting, panel-mounting, tension and wide-tolerance Dzus fasteners.

Ekco Electronics, Ltd. (182 and O.D.S. O and 6). Ekco type E117 machine-tool control with punched-card information storage system; Ekco type E160 airborne search radar intended for Vanguard, Comet 4 and Boeing 707.

H. W. Edghill and Co., Ltd. (O.D.S. K and 16). Self-propelled Autostair passenger embarkation steps mounted on Austin 152 Omnitruck chassis. Steps are electro-hydraulically adjustable between 8 ft. 4 in. and 11 ft. 8 in. height. Engine stand for the Rolls-Royce Avon R.A.29.

Electro-Hydraulics, Ltd. (167). Working model of E-H quadricycle undercarriage configuration; E-H lift and roll unit for freight loading; titanium specimens; selection of hydraulic components; new nickel brazing technique.

Elliot Equipment, Ltd. (91). Designers and manufacturers of air/sea rescue equipment.

Elliott Brothers (London), Ltd. (226 and O.D.S. 8). Main exhibits include general-purpose test missile fully equipped with radar homing system; Type E.B.20 automatic flight-control system for aircraft; Polar-path compass system; fuel-flow master system; air data computer; autopilots for drone and supersonic aircraft; communications and navigation equipment; airborne weather radar.

E.M.I. Electronics, Ltd. (124). Telemetry equipment for transmission of data from guided missiles while in flight; illustration of laboratory testing of this equipment for reliability. Electronically controlled rotary positioning table for machine tools.

E.M.O. Instrumentation, Ltd. (179). Torque-measuring machine for testing complete synchros; bearing-washing machine; precision bearings for aircraft instruments.

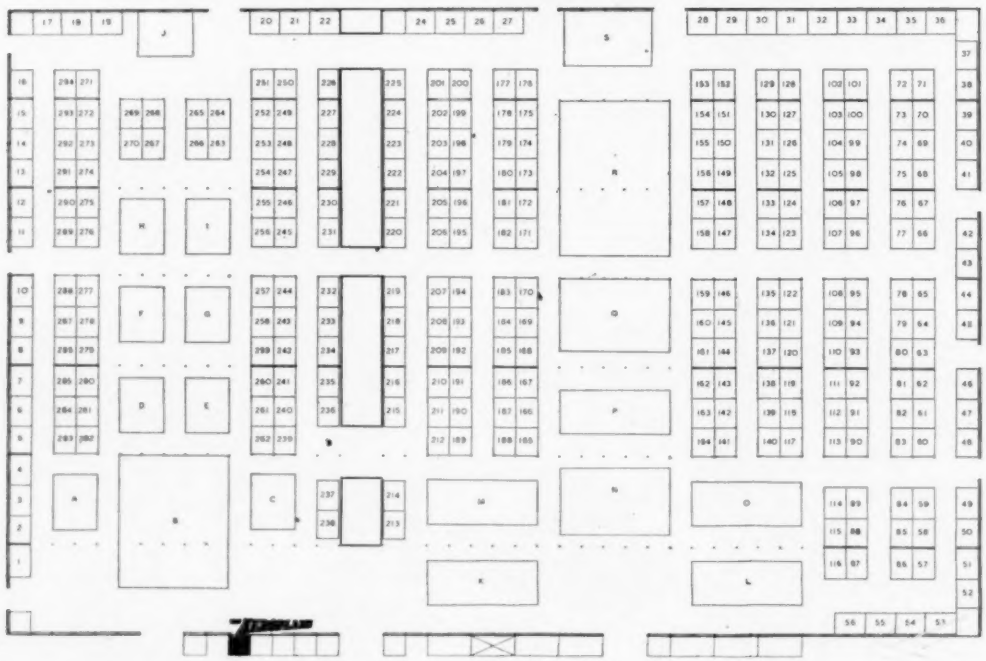
The English Electric Co., Ltd. (O, 201, 202 and 203). Sectioned (hydro-electric) power pack for Thunderbird guided weapon. Precision gyros; miniature integrated gyros; stabilized platform for testing of gyros used in inertial guidance; dynamic test equipment for gyros.

English Steel Corporation, Ltd. (114). Selection of drop-forged components for airframes, engines and rockets; special aircraft and tool steels; comprehensive range of engineers' cutting tools.

E.N.V. Engineering Co., Ltd. (173). Precision spiral bevel-gears developed for helicopter rotor drives, including units for

(*Continued on page* 333)

THE INDOOR EXHIBITION



PRINCIPAL EXHIBITORS

Company	Stand No.
Alvis, Ltd.	E
Blackburn & General Aircraft, Ltd.	P
Boulton Paul Aircraft, Ltd.	J
Bristol Aircraft, Ltd. / Bristol Aero-Engines, Ltd.	Q
The de Havilland Enterprise	B
The English Electric Co., Ltd.	O
The Fairey Aviation Co., Ltd.	K
Folland Aircraft, Ltd.	I
Handley Page, Ltd.	M
Hawker Siddeley Group	R
Hunting Aircraft, Ltd.	A
Ministry of Supply	H
D. Napier & Son, Ltd.	L
Rolls-Royce, Ltd.	N
Saunders-Roe, Ltd.	D
Scottish Aviation, Ltd.	F
Short Bros. & Harland, Ltd.	C
Vickers-Armstrongs (Aircraft), Ltd.	S
Westland Aircraft, Ltd.	G

Guide to the Stands . . .

(*Continued from page* 332)

Westland Westminster and Wessex, Bristol Type 192 and Sycamore, Saunders-Roe Skeeter and Sud-Aviation Alouette 2.

Esso Petroleum Co., Ltd. (66). The stand takes the form of an advisory bureau where the company's technical staff will discuss any problems concerned with purchase, handling, storage and use of Esso fuels and lubricants produced for the aviation industry.

Exactor, Ltd. (140). Fuel-flow test-rig; portable pumping and filtration unit; various self-sealing pipe connections; and missile-launching equipment. Drop tank self-sealing connections and pre-production "balanced" coupling.

Export Packing Service, Ltd. (289 and O.D.S. E). Specialists in packing of aircraft components, radio and electronic equipment.

The Fairey Aviation Co., Ltd. (K and 213). Rotodyne rotor blade; steel castings; electrically signalled power control and other power-control exhibits.

Ferranti, Ltd. (136 and 137). Graphic display of Airpass radar fire-control system developed for English Electric Lightning; gyro gunsight; printed circuits; aircraft instruments and other airborne equipment.

Dennis Ferranti Meters, Ltd. (93). Electrical armament and oxygen equipment including voltage regulators, distributors, release units, and economizers; electronic instrumentation; test equipment; glass-fibre-reinforced laminates; Ear Defender.

Fibreglass, Ltd. (251). Use of Fibreglass insulation and reinforced plastics in aircraft. Exhibits include battery boxes, a tail-light fairing and lifebelt container.

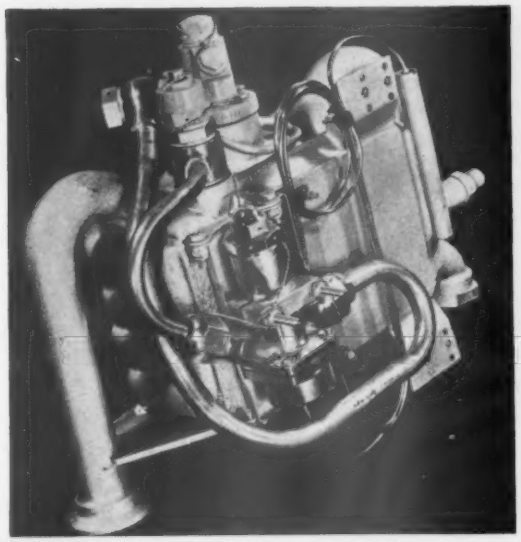
Field Aircraft Services, Ltd. (8). Illustration of the company's sales, overhaul and servicing activities of aircraft and engines.

Fireproof Tanks, Ltd. (55). New items include a rigid, but collapsible container; inflatable bag for shoring-up cargo to prevent movement; inflatable helicopter pontoon; Hycatrol flexible lightweight fuel tank; PVC tank for missiles; moulded fuel-system components.

Firestone Tyre and Rubber Co., Ltd. (86). Examples of several types of aircraft tyres, tubeless and tubed, from the company's wide range.

T. F. Firth and Sons, Ltd. (18). Makers of upholstery fabrics and carpeting for aircraft cabins.

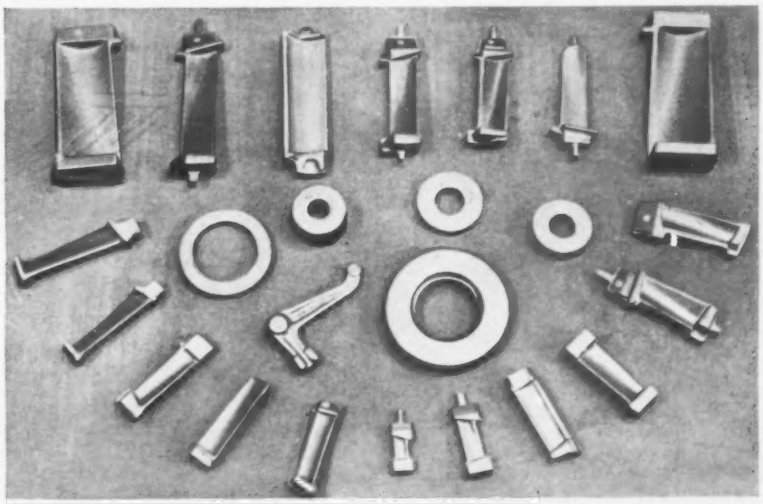
Thos. Firth and John Brown, Ltd. and **Firth-Derihon Stampings, Ltd.** (186 and 187). Bright steel bars; range of aircraft components in Firth Brown steels; Firth-Derihon drop forgings, including turbine discs and blades.



Right, a D.H. Propellers Ltd., evaporator pack with thermostatic expansion valve for a vapour cycle ventilated suit system.

The indicator unit of the new Ekco VHF automatic direction finder type CE 178.

Firth-Vickers Stainless Steels, Ltd. (153). Selection of centri-spinnings; static sand and investment castings including investment casting of an artificial-horizon chassis.



Typical drop forgings that can be seen on the stand of Firth-Derihon Stampings Ltd.

W. T. Flather, Ltd. (141). Steels for airframe, internal fittings and ground-equipment components.

Flight Refuelling, Ltd. (175). Various types of fuel system components manufactured for both ground and in-flight refuelling. HTP handling equipment and a working model of helicopter equipped for in-flight refuelling.

Howard Flint, Ltd. (145). Manufacturers of flying-clothing.

Folland Aircraft, Ltd. (I). Complete rear fuselage for Gnat Mk. 1; 66-gal. all-metal drop tank; a Folland type 4 ejection-seat similar to that to be fitted to Gnat Trainer.

Fothergill and Harvey (Sales), Ltd. (249). Weavers of textiles, including plastics reinforcement and other fabrics woven from glass yarn.

Samuel Fox and Co., Ltd. (96). Colour diorama of steelmaking process, 18 special steels supplied to aircraft industry and stainless-steel link fencing.

P. Frankenstein and Sons (Manchester), Ltd. (219 and O.D.S. T.). The new Beaufort 26-seat aircraft dinghy; baby's floating survival cot; lifejackets and items of high-altitude protection.

Thomas French and Sons, Ltd. (17). Products are fabric, metal and fabric, and metal gun belts and links for quick-firing guns; belt-filling machines for cartridges and shells.

Garringtons, Ltd. (233). Compressor and turbine blades forged to oversize, close or precision limits in various alloys; hand tools for the aircraft industry.

The Gear Grinding Co., Ltd. (248). Producers of aircraft gears, both spur and helical, and similar components.

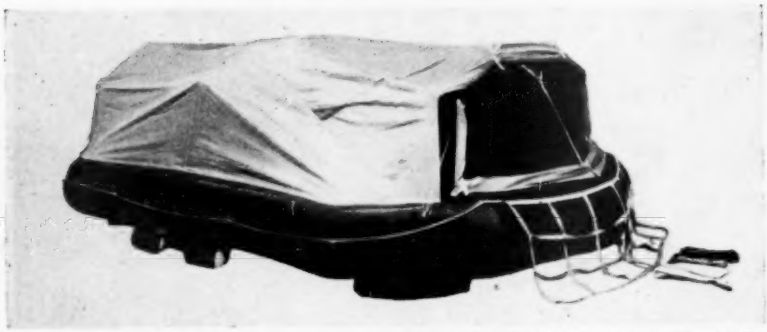
The General Electric Co., Ltd. (273 and 274). Latest developments in airborne radar, airfield and aircraft lighting, instruments and catering equipment. New air-circulation oven; fluorescent aircraft lighting units; D.H. Sea Vixen radar and other electronic components.

Girling, Ltd. (276). Supermarine Scimitar fin and rudder fitted with Girling control dampers; control and anti-flutter dampers for ailerons and other surfaces.

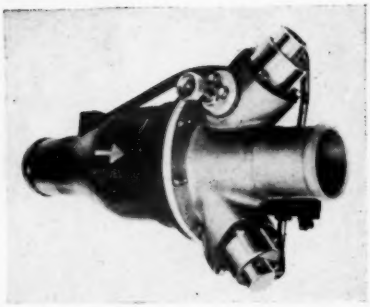
Gloster Engineering (Cheltenham), Ltd. (217). Range of tools in laminated woods and paper-based materials, including templates and rubber-press dies. A variety of tools in steel.

Sir George Godfrey and Partners, Ltd. and **Godfrey Engineering Co., Ltd.** (24 and 25). New air-conditioning pressurization and turbo-alternator equipment in production for Vanguard, Argosy, Gannet, Canberra PR.9, Lightning, Vulcan and Victor.

Guide to the Stands . . . .



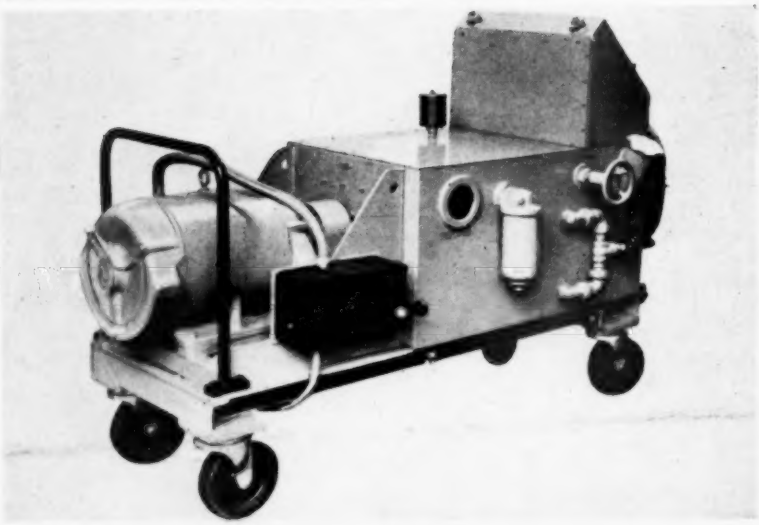
Above, the new Beaufort 26-seater aircraft dinghy developed by P. Frankenstein and Sons, Ltd. It has a brilliant orange daylight fluorescent canopy.



Right, a Flight Refuelling Mk. 39 refuelling/defuelling valve capable of passing fuel at 240 g.p.m. refuelling and 100 g.p.m. defuelling. Special features include electrical selection with an anti-surge unit.

Left, built-in double- and triple-units, these folding seats have been developed by Transport Seating, Ltd., for the Armstrong Whitworth A.W.650 Argosy.

Below, the Fawcett Preston P.3.G. mobile pump capable of delivering 2½ g.p.m. of oil at 5,000 p.s.i. The discharge pressure can be varied between 1,000 and 5,000 p.s.i. by means of automatic relays and an adjustable regulating valve.



Goodmans Industries, Ltd. (264). Vibration equipment capable of exerting loads up to 10,000 lb.; prototype model of sweeping sine-wave oscillator; E.501 amplifier.

The Goodyear Tyre and Rubber Co. (Great Britain), Ltd. (14). First showing of trimetallic disc brake for Viscount 810 series and Goodyear skid-warning system. Double-disc cluster-type brake; hydraulic brake control system components; pneumatic/hydraulic converter unit.

G.Q. Parachute Co., Ltd. (52). Manufacturers of flying clothing, pressurized and air-ventilated suits, parachutes and harnesses.

Graseby Instruments, Ltd. (228). Universal gyro tester for checking all types of freedom gyros as those for inertial navigation systems; polar-axis pattern gyro tester; three-axis accelerometer unit.

Graviner Manufacturing Co., Ltd. (236). Visual fire monitor; flame-out indicators; Firewire control unit using magnetic amplifiers; automatic extinguishers using bromotrifluoromethane; high-*g* inertia switch for guided weapons; Fenwal fire and overheat detection system.

Guest, Keen and Nettlefolds (Midlands), Ltd. (147). Producers of a wide range of fasteners for the aircraft industry; Aerotight nuts and other similar items.

J. J. Habershon and Sons, Ltd. (262). Hot- and cold-rolled steel strip and sheet to A.I.D. specifications; examples of material from the new Sendzimir Planetary hot-rolling mill.

Hadfields, Ltd. (290). Producers of high-quality alloy steels for airframes and engines; heat and corrosion-resisting steels; gas-turbine components.

The Hairlok Co., Ltd. (68). Moulded rubberized hair protective packaging for guided-weapon equipment; aircraft seats incorporating Hairlok/Texfoam, and Latex foam cushions.

Hall and Hall, Ltd. (268). Natural and Hallprene synthetic rubber sheetings, extrusions and mouldings; Hallprene fluid seals; O-rings and silicone seals; Hallite jointings.

John Hall and Sons (Bristol and London), Ltd. (189). Manufacturers of aircraft finishes including aero-engine paints, dopes, varnishes, lacquers and so on.

Harley Aircraft Landing Lamps (49). Producers of a range of taxi-ing and landing lamps and mobile floodlights.

Hawker Siddeley Group (R). A 15-ft. long section of Armstrong Whitworth A.W.650 Argosy fuselage, fitted with folding seats and also showing how freight is carried. A model guided-weapons ship showing internal handling gear for the A.W.A. Seaslug. A waterproof switch made to withstand the strains imposed by missile flight. Armstrong Siddeley auxiliary power-unit gas turbines (AiResearch licence). Hardened ball and circulating lead-screws (Beaver Co. licence). True mass-flow meters and other equipment by the technical developments division of Gloster Aircraft. A display of weapons research equipment by A. V. Roe, including apparatus for the evaluation of low wander-rate gyroscopes.

Heenan and Froude, Ltd. (41). Scale model of Rolls-Royce Conway thrust cradle, and model of torque-reactor stand.

Hellerman, Ltd. (107). Hellerman cable-binding system; compression terminals and tools; seating devices and connectors; cable-fixing accessories and wiring tools.

W. T. Henley's Telegraph Works Co., Ltd. (71). Representative selection of aircraft cables including Tersil and Nyvin types, equipment wires for guided missiles; electrical equipment.

Hepworth and Grandage (Yeadon), Ltd. (120). Comprehensive range of turbine blades.

High Duty Alloys, Ltd. (214). Die forging of Vulcan undercarriage leg; examples of precision forgings produced in totally enclosed dies; draftless forgings and forgings designed to replace castings.

High Pressure Components, Ltd. (193). Manufacturers of Gyp range of pipe-to-pipe and re-usable hose couplings; various types of charging and relief valves.

(*Continued on page* 335)

Guide to the Stands . . . .

(*Continued from page* 334)

H. M. Hobson, Ltd. (156). New items include hydro-mechanical constant-speed alternator drives; fuel-flow proportioner; reheat control system; flap control and feel simulator units; cockpit, engine and powered flying controls.

H.M.L. (Engineering), Ltd. (O.D.S. 1). Manufacturers of Diesel- and electric-powered universal hydraulic test rigs.

Hordern-Richmond, Ltd. (122). Main- and tail-rotor blades for Saunders-Roe P.531; jigs and tools for producing Hydulignum and Jabroc wood, Hyroc paper and Permaglass glass-fibre laminations, and other rotor-blade units.

The Hughes-Johnson Stampings, Ltd. (59). Producers of various types of forgings in steel and non-ferrous metals.

Hunting Aircraft, Ltd. (A and 7). Photographs of Jet Provost, Pembroke and President.

The Hymatic Engineering Co., Ltd. (267). New equipment includes servo-operated axial-flow valve for controlling flow of hot, high-pressure gas; anti-*g* valves; reducing valve for high-test peroxide; electro-magnetic stop valves.

Houchin, Ltd. (O.D.S. H). Three new aircraft electrical servicing trollies. Mk. 1 for aircraft with 112-V. DC, 28-V. DC, or 200-V. AC, 400 c.p.s. systems; HY-CY for aircraft having 200-V. AC, 400 c.p.s. and 28-V. DC systems, and Mk. 5 for 28-V. DC aircraft systems.

Imperial Chemical Industries, Ltd. (Metals Division). (89). Titanium exhibits including a 2-ton ingot melted at the company's furnaces at Witton; helicopter engine cowling; blown-flap duct assembly; compressor blades; titanium extrusions; tubes for hydraulic systems.

Imperial Chemical Industries, Ltd. (Paints Division). (90). Information on I.C.I. range of metal pre-treatment processes and paint systems approved for the aircraft industry.

Imperial Chemical Industries, Ltd. (Plastics Division). (83). Darvic rigid P.V.C. sheeting; Fluon plastic products; range of oil-resistant components made from Butakon rubbers.

Integral, Ltd. (155). New hydraulic power-pack units designed for Dart Herald and Argosy; hydraulic pumps; four-channel mass flowmeter. Electric and hydraulic motor-pump units; fuel flowmeters.

Irving Air Chute of Great Britain, Ltd. (283). Barometric power unit for the automatic opening of parachutes; electric and electro-mechanical cord cutters; parachute-recovery system for a guided missile; landing brake parachute.

Jablo Propellers, Ltd. (212). Lightweight expanded plastic materials for aircraft thermal insulation and upholstery, and for insulation of hangars and aircraft factories. Laminated plastics for press tools and so on.

William Jessop and Sons, Ltd. (31). Emphasis on the use of Hylite titanium alloys and Vacumelt vacuum-melted steels in modern aircraft design. Machined forgings and stampings in vacuum-melted steels.

K.L.G. Sparking Plugs, Ltd. (1). See Smiths Aircraft Instruments, Ltd.

Kelvin and Hughes (Aviation), Ltd. (4). See Smiths Aircraft Instruments, Ltd.

The Kenilworth Manufacturing Co., Ltd. (285). Double Bond chemically curing filler; Red Hermetite non-hardening jointing paste; Kwikfill polyester deep filler; jointing compounds and metallic paint.

Kent Alloys, Ltd. (99), **The Phosphor Bronze Co., Ltd.** (100), and **Laycock Engineering, Ltd.** (101 and O.D.S. S). Castings, machined parts and assemblies in aluminium, magnesium, magnesium-elektron-zirconium and other alloys. Precision castings for radar and communications equipment.

The Walter Kidde Co., Ltd. (128) Oxygen equipment; dinghy and life-jacket inflation units, and other life-saving equipment.

King Aircraft Corpn. (53). New components include case-latch and hook-bolt fasteners; twin-gimbal flexible metallic and fly-off couplings; breather valves; Kingflex plastic hose; access covers and swaged control rods.

Lancefield Aircraft Components, Ltd. (278). Radar waveguides; aircraft seats; Lancedown lightweight upholstery filling; stainless-steel exhaust manifolds and general sheet-metal work.

Latex Upholstery, Ltd. (19). Luxury- and economy-class passenger chairs; lightweight upholstery fillings; freight containers; textile equipment.

Laycock Engineering, Ltd. (101 and O.D.S. S). See Kent Alloys, Ltd.

Lep Transport, Ltd. (244). Specially designed packing case, and examples of pre-packing.

Lockheed Hydraulic Brake Co., Ltd. (43). Hydraulic equipment including pumps, cut-out valves, selector valves, and fully powered Servodyne flying controls.

Lodge Plugs, Ltd. (176). Aircraft sparking plugs and igniters; plug servicing equipment; Sintox special products.

Long and Hambly, Ltd. (54). Specimens of rubber and plastics mouldings in natural and synthetic rubbers; silicones, and injection-moulded plastics. Extrusions and sheeting in natural and synthetic rubbers.

Joseph Lucas (Batteries), Ltd. (246 and O.D.S. 9). Airborne and ground batteries including lightweight ventilated and unspillable airborne battery in three versions.

Joseph Lucas (Gas Turbine Equipment), Ltd. (252 and O.D.S. 9). Comprehensive range of fuel-system components, combustion equipment, hydraulic pumps and motors; constant-speed hydraulic drives; miscellaneous products.

Lucas-Rotax, Ltd. (253 and O.D.S. 9). See Joseph Lucas, Ltd. and Rotax, Ltd.

Magnesium Elektron, Ltd. (113). Extractors of magnesium; production of magnesium ingot, bar, billet, slab and powders; magnesium alloy tooling plate.

Manchester Oil Refinery, Ltd. (196). Fluids for non-destructive flaw detection; mechanical seals for rotary shaft mechanisms.

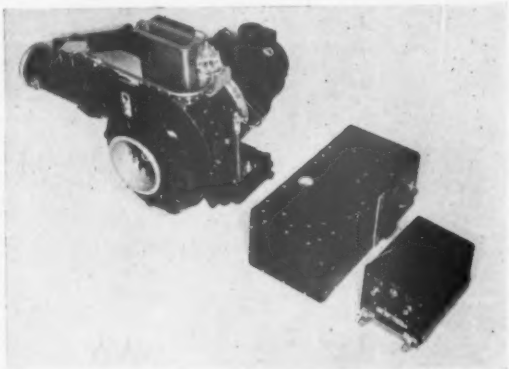
McMichael Radio, Ltd. (27). Telemetry receiving system which records data received from guided missiles in flight, and a Sonobuoy transmitter.

M.L. Aviation Co., Ltd. (26 and O.D.S. R). Latest pressure-helmet and relevant test gear; new high-pressure coupling system; range of electrical test equipment; production Coolair Mk. 5 unit for cooling bomber crew cabins on the ground; missile stands and transporters.

Marconi's Wireless Telegraph Co., Ltd. (222 and 223), **Canadian Marconi Co., Ltd.** (225), **Amalgamated Wireless (Australasia), Ltd.** (224), and **Marconi Instruments, Ltd.** (221). Display of electronic equipment including Doppler Navigators, with the overall theme of A.T.C. New units include synthetic plan position display; future-position indicator; D/F super-imposition equipment; inter-console marking equipment; trackers' console; "track-while-scan" and rate-aiding equipment; approach console.

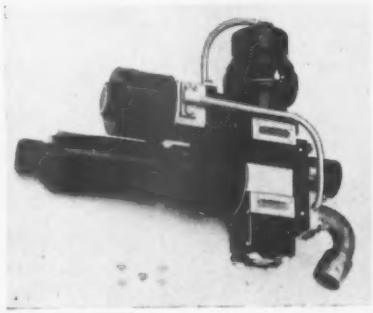
Marston Excelsior, Ltd. (84). New Portolite flexible tank for transport and storage of aircraft fuels; aircraft heat exchangers in both titanium and stainless steel; flush butt-welded titanium rings; Marlite and Flexelite fuel tanks.

Martin-Baker Aircraft Co., Ltd. (231 and O.D.S. G). Mk. G5 ejection seat as supplied to the U.S. Navy for Chance Vought Crusaders; Mk. A5 seat for Grumman Cougar Trainers; mobile ejection-seat trainer.



Right, the Godfrey TGA-3 turbo-alternator with its frequency control unit developed in collaboration with Fergussons, Ltd. The alternator has an output of 30 kVA, at a power factor of 0.8.

Below, a Hymatic anti-*g* valve incorporating an automatic device to inflate the anti-*g* suit to accurately controlled pressures instantaneously if cabin pressure is lost.



Left, one of the range of AC/DC ground servicing trollies developed by Houchin, Ltd. The outputs of the set include 200 V. 400 cycle AC and 28 V. DC supplies.

Guide to the Stands . . . .

Metachemical Processes, Ltd. (76). Full Dalic plating equipment consisting a work-table, power unit and turning head; Viscount propeller blade with micrograin nickel electro-formed sheath; Tyne intake section incorporating micrograin nickel; and other components.

Microcell, Ltd. (61). Several types of glass-fibre rocket launchers; glass-fibre radomes for high-speed aircraft; aircraft passenger seats ranging from the sleeper type to the new tourist-economy type.

F. G. Miles, Ltd. (242). Demonstration of electronic simulator representing typical gas-turbine engine; "building brick" system of simulator components; aircraft indicators; electric actuators; asbestos-phenolic high-pressure mouldings; and P.V.C. glass-fibre fabrication work.

Ministry of Supply (H). Pilot's view-simulator showing in perspective a forward view which changes in accordance with movements of the aircraft. Three-dimensional continuous automatic measuring machine, which is an existing machine tool converted into a tape-control inspection machine by fitting Ferranti machine-tool control and the I.E.M.E. measuring system. Details of simulated flight-testing of ramjets and of the liquid-cooling of airborne radar equipment.

Mollart Engineering Co., Ltd. (58). Heavy-duty halo-ring universal joints; precision-machined aircraft components; prototype assemblies and gearboxes.

Mond Nickel Co., Ltd. (271). Refiners of nickel.

Morfax, Ltd. (O.D.S. 4 and P). Hydraulically operated elevating strip/build stand for large turbojets; stands for Rolls-Royce Darts; towbar and oleo-leg jack for Viscount aircraft; examples of prototype components.

George Spencer Moulton and Co., Ltd. (62). Producers of elastomers to specialized requirements of aircraft industry. Natural and synthetic rubbers for seals, hoses and anti-vibration mountings.

Murex Welding Processes, Ltd. (259). Various types of ground power units for servicing and starting both piston and gas-turbine engines.

Murphy Radio, Ltd. (194). New equipment includes MR 310 T passenger announcement equipment; MR 380 airborne tape recorder; Rebecca 8F airborne navigational aid and MR 347 transportable radar beacon.

D. Napier and Son, Ltd. (L and 116). Selection of investment castings for aircraft industry; display of research activities; some examples of Spraymat ice protection.

Negretti and Zambra, Ltd. (77). Fuel flowmeters with integrator; temperature- and pressure-sensitive units; pressure switches; meteorological instruments; test-bed thermometers.

Louis Newmark, Ltd. (210). Designers and manufacturers of auto-stabilization and auto-pilot equipment for fixed-wing aircraft and helicopters.

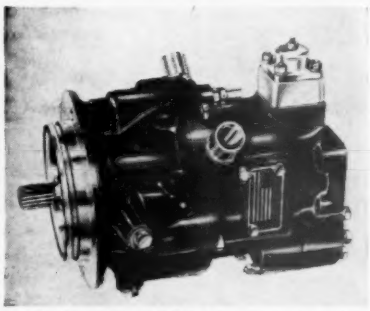
Newton Brothers (Derby), Ltd. (87). Electrical equipment for aircraft including automatic carbon-pile voltage and current rectifiers; rotary transformers and converters; AC and DC generators; high-frequency alternators; split-field motor generators.

Normalair, Ltd. (292) with **Normalair (Australia) Pty., Ltd.** (293), and **Normalair (Canada), Ltd.** (291). Highlights of the development and testing facilities now operated by the company, with a variety of equipment showing the scope of their current activities. Items include vapour-cycle cooling exhibit, cabin air cooling systems and lightweight oxygen-supply equipment.

Northern Aluminium Co., Ltd. (134). An aircraft structural member, 9 ft. by 2 ft. 6 in. by 1¼ in., machined from one piece of aluminium plate; hand forging in Noral B75S, 5 ft. long and weighing ¼ ton; Noralduct roll-bonded heat-exchanger plate; Noral extruded sections.

Optical Measuring Tools, Ltd. (192). A 30-in. rotary indexing table fitted with Ekco control unit for automatic setting of pre-selected angles; other models of optical indexing tables.

Palmer Aero Products, Ltd. (171). Palmer Fluoroflex dispersion polymer P.T.F.E. hydraulic hoses with swaged-on or re-usable end fittings; lightweight electrical engine harness; oxygen reducing valves; details of non-destructive testing of aircraft components.



The Lucas type HOD pump for aircraft hydraulic systems. Incorporating flow limiting and constant pressure valves, it has a rated flow of 20 gal./min. at 2,500 r.p.m.

R. and J. Park, Ltd. (154). Export packers and shippers.

Peto and Radford (256). The 24-V. 12-ECM.13-VA aircraft battery fitted in Vickers Viscount; 12-ECE.13-VB battery for D.H. Comet 4; examples of ground starter batteries.

The Phosphor Bronze Co., Ltd. (100). See Kent Alloys, Ltd.

Plannair, Ltd. (70). The 9P6 241-274 axial-flow blower developed for cabin-air recirculation in Vanguard; 11PL 141-123 axial-flow blower for Rotodyne; multi-stage compressor for NA.39; other installations for military and civil aircraft.

The Plessey Co., Ltd. (46), **Plessey International, Ltd.** (47), and **Wireless Telephone Co., Ltd.** (48). Airborne transmitter/receiver AN ARC.52 made under licence from Collins Radio Co.; Type PVR.102A radio teleprinter; Type PG.79 transmitter drive unit; lightweight VHF transmitter/receiver Type PTR.61.

Precision Rubbers, Ltd. (288). Typical examples of all types of rubber components, including sleeves, bushes, diaphragms, mouldings, extrusions and electrical units in natural, synthetic and silicone materials.

Fawcett Preston and Co., Ltd. (106). P.3.G mobile oil pump capable of delivering 2.5 gal./min. at 5,000 p.s.i.; Green-Mercier hydro-pneumatic accumulators; ripple eliminators for the absorption of pressure pulses in hydraulic lines; hydraulic valves; pulsation-damping rig.

R. B. Pullin and Co., Ltd. (80). Range of servo components including servo motors, motor generators, synchros, transistorized amplifiers, magnetic amplifiers, sealed relays, a 35-mm. ciné-camera for missile target aircraft, electrical turn-and-slip indicators; 3-W. motor-generator and a transistor servo-amplifier.

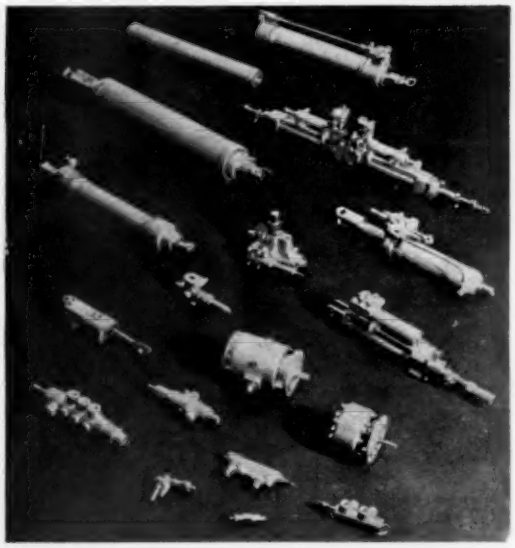
The Pulsometer Engineering Co., Ltd. (184). Fuel booster, water service and other centrifugal pumps for aircraft. Fuel booster pumps from 10 to 30,000 g.p.h. rate of flow including AC and DC motor-driven units, double-ended pumps and those driven by air turbines. High-vacuum pumps for instrument testing.

J. B. Purefoy Unit Tooling Co., Ltd. (180). Specialists in design and manufacture of standard parts and components for jigs and fixtures.

Pye, Ltd. (227). Engine overspeed and rotation indicators developed for Rolls-Royce Conway; miniature four-channel VHF receiver; various VHF and HF transmitters. Pye instrument-landing system; 75 Mc./s. en route marker beacon; test instruments.

(*Continued on page* 337)

Above, the Integral type 276 power pack comprising a hydraulic pump, electric motor and hydraulic reservoir. It supplies a minimum of 1.45 g.p.m. at 3,000 p.s.i. at a motor speed of 7,500 r.p.m.



Left, a selection of some of the units in the Lockheed range of power assisted flying controls, pumps, accumulators and cut-out valves.

Guide to the Stands . . . .

(*Continued from page* 336)

The Pyrene Co., Ltd. (60 and O.D.S. Q.). Fire-detecting and extinguishing systems for aircraft, including smoke- and fire-detector systems. Complete fire-safety equipment for aircraft and airfields. Airfield crash tenders.

The Rawlplug Co., Ltd. (102). Rawlnut fixing devices and several other types of all-metal "blind" fixing devices.

Redifon, Ltd. (78 and 79). Development and manufacture of MF, HF and VHF radio communications; navigational and airfield equipment including transmitters, receivers and radio beacons. Flight simulators, synthetic trainers and radar trainers.

Reliance Cords and Cables, Ltd. (104). Producers of rubber mouldings, wire and cables; aerodrome lighting and communications equipment; aircraft wiring; guided-weapons instrumentation and rescue equipment.

Rellumit (London), Ltd. (73 and O.D.S. M). Manufacturers of aircraft-refuelling equipment including micro-filters, air eliminators, water separators and coarse filters.

Reynolds (Packaging), Ltd. (119). Export packers of electronic, radio, engineering, vehicle, aircraft and guided-weapon components.

Reynolds T.I. Aluminium, Ltd. (170). Fabricators of structure using aluminium-alloy tubes, extrusions and sheet; manipulated steel and light-alloy tubes and sections; seamless light-alloy pressure vessels; hollow forgings in steel and light alloy.

Reynolds Tube Co., Ltd. (238). Typical flange rings in Nimonic, titanium and aluminium alloys; selection of ring cross-sections; section of Bristol drop tank; hollow extrusions in steel and aluminium alloys; seamless assemblies.

R.F.D. Co., Ltd. (123). Type 50 C Mk. 2A civilian lifejacket; six-man universal liferaft for civil transports; military single-seat dinghy, including emergency pack; new twin-compartment lifejacket for civil aircraft.

Rollason Aerocessories, Ltd. (243). Designers and makers of quick-release cargo-securing equipment, including helicopter cargo-release hooks; sensitive control and pressure-regulating valves; range of testing and servicing equipment including hot-spray defrosting trolleys.

Rolls-Royce, Ltd. (N). Thrust-reverser and noise-reducer unit for the Conway R.Co.10 by-pass turbojet. Afterburning jet pipe for Avon R.A.24 military turbojet.

Rotax, Ltd. (254 and O.D.S. C and 9). Emphasis on constant-frequency AC systems; brushless alternators; ram-air turbo-alternators; transistorized inverters; magnetic amplifier applications and a new range of AC switchgear; low-pressure air starter equipment.

Rotol, Ltd. (30). Viscount propeller with trapezoidal planform blades; propeller-synchronizing equipment; turbo-alternators; powered fuel-flow proportioner; ram-air turbine; accessory gearboxes for Viscount and Javelin.

Rover Gas Turbines, Ltd. (O.D.S. 10). Rover 1S/60 airborne auxiliary powerplant designed to provide emergency electrical power for essential flight services and an independent supply of compressed air for engine starting.

Rubery, Owen and Co., Ltd. (168). Range of components for transport aircraft and guided missiles; examples of nuts and bolts to all specifications; machined assemblies.

Salford Electrical Instruments, Ltd. (272). Precision potentiometers; quartz crystals; radio coils, selenium rectifiers; capacitors; aircraft circuit-breakers.

W. H. Sanders (Electronics), Ltd. (111). Double-ridge waveguide run for Viscount and Britannia. Complete microwave analytical test-bench. Range of flexible wave-guide assemblies.

Sangamo Weston, Ltd. (157). New jet-pipe temperature indicators of circular scale pattern; ratiometer type of instruments for indication of temperatures, pressures and positions; navigation aids; ground test sets.

Joseph Sankey and Sons, Ltd. (65). Spinners for Napier Eland and Rolls-Royce Tyne; ammonia cylinders for guided-weapons use; flame tubes, combustion chambers, discharge nozzles and other components for various engine manufacturers.

Saunders Valve Co., Ltd. (279 and O.D.S. 5). Manual and motorized versions of Mk.4 series of Saunders spherical plug valves; toilet effluent valve; Safran H.T.P. pump; valves for special fluids.

The Schermuly Pistol Rocket Apparatus, Ltd. (245). Range of aeronautical pyrotechnic stores; turbojet starters; helicopter emergency landing flares; guided-missile tracking flares; distress pistols and cartridges.

Sciaky Electric Welding Machines, Ltd. (69). Range of resistance-welded aircraft components; typical control cabinet for a Sciaky three-phase light-alloy welding machine; Dekatron control circuits.

Tom M. Scotney, Ltd. (92). Makers of jet-pipe and engine stands; specialized containers for transportation of engines and guided weapons.

Scottish Aviation, Ltd. (F). Section of Twin Pioneer outer wing showing high-lift devices in operation.

Serck Radiators, Ltd. (72). Manufacturers of heat-exchangers including radial-flow oil coolers; light-alloy high- and low-pressure fuel-cooled oil coolers; fuel-heated matrices for fuel filter de-icing.

The Sheffield Smelting Co., Ltd. (286). Selection of precious-metal contacts for aircraft switches and relays; various types of switchgear showing contacts; wrought and sintered precious metals; silver solders; aluminium sand castings.

Shell-Mex and B.P., Ltd. (207). The stand forms an animated science-fiction scene of space travel. A display describes the quality control of aviation turbine fuels.

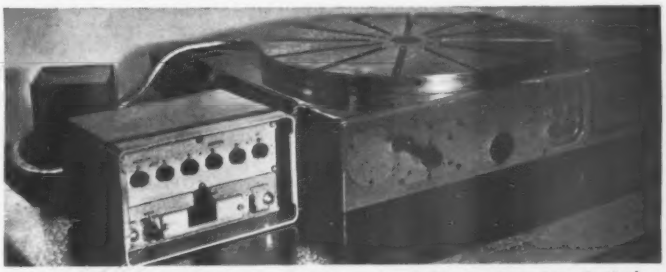
Short Brothers and Harland, Ltd. (C). Model landscape with VTO strike aircraft taking off from concealed bases; aircraft seats; radio control system for aircraft; auto-stabilizer components.

Siebe, Gorman and Co., Ltd. (237). New-pattern flying overalls; pump for charging 750-litre oxygen cylinders; "Vista" mask for air supply to workers in confined spaces; aircraft seat belts; portable emergency oxygen sets for aircraft crew members.

Simmonds Aerocessories, Ltd. (195 and O.D.S. B). Theme of the display is the handling of aviation fuels. Firth Cleveland Instruments flow meters; Pacitor and Pacitran fuel gauges; Simmonds Fram water separator/filters and flow-control equipment; Nyloc self-locking nuts and Spire Speed Nuts.

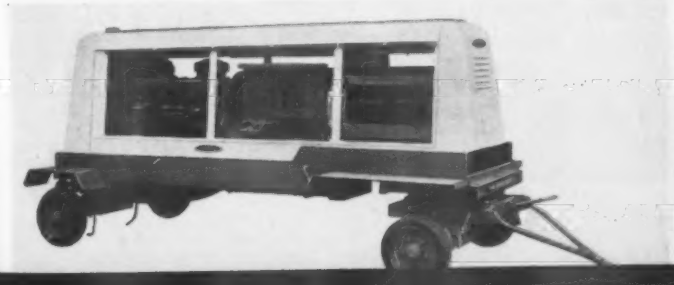
Skyhi, Ltd. (185) Four new items: power-operated heavy-duty tripod wing jack; twin-wheel-change double-ram jacks for use on bogey undercarriages; 30-ton wheel-change double-ram jack; and 3-ton double-ram tripod jack.

Smiths Aircraft Instruments, Ltd. (3) with their associates, **Kelvin and Hughes, Ltd.** (4 and O.D.S. 15), **K.L.G. Sparking Plugs, Ltd.** (1) and **Waymouth Gauges and Instruments, Ltd.** (2). Smiths flight system and SEP.2 automatic pilot; jet-pipe temperature controls; miniature AC motors and generators; Kelvin Hughes flight data system; Kelvin Hughes rapid-processing photographic projector; Doppler controlled map-roller equipment; ignition units and aircraft instruments.



A new automatic positioning rotary indexing table developed by Optical Measuring Tools, Ltd. It is fitted with an Ekco control unit.

Hydraulically operated elevating strip/build stand for large engines such as the Rolls-Royce Tyne, Conway and Avon. Built by Morfax, Ltd., it has a 10-ft.-square working platform.



The Murex type 8940 Diesel-engine-driven aircraft ground power unit used for servicing and starting both piston and turbojet powerplants.

Guide to the Stands . . . .

Smiths Stamping Works (Coventry), Ltd. (32). Compressor wheels and turbine discs, including components in Nimonic and titanium alloys.

Solartron Electronic Group, Ltd. (247). Designers and producers of radar simulators, magnetic tape-recorders, transfer-function analysers and other electronic devices.

Southern Forge, Ltd. (277). Demonstration of quality-control method used by the company; selection of aircraft stampings in various finishes; extrusions and tubes.

Southern Instruments, Ltd. (121). Makers of electronic instruments including double-beam oscillographs, drift-corrected DC pre-amplifiers; universal recording cameras; two-channel pen recorders; range of transducers.

Sparklets, Ltd. (132). Manufacturers of dinghies and life-jacket inflation mechanisms; pressure die-castings in aluminium; woven wire braiding for pressurized hose and earthing strip.

S.P.E. Co., Ltd. (117). Full range of fuel-booster pumps of both AC and DC motor types, including double-ended fuel pumps. Pumps for water-methanol injection and hydrogen peroxide.

The Sperry Gyroscope Co., Ltd. (152). The Introview flaw-detector, manufactured by Sperry under licence from I.C.I., Ltd. for in-service inspection applications; Vickers (Detroit) hydraulic components; conventional aircraft instruments, including electric gyro horizons, compasses and gyropilots.

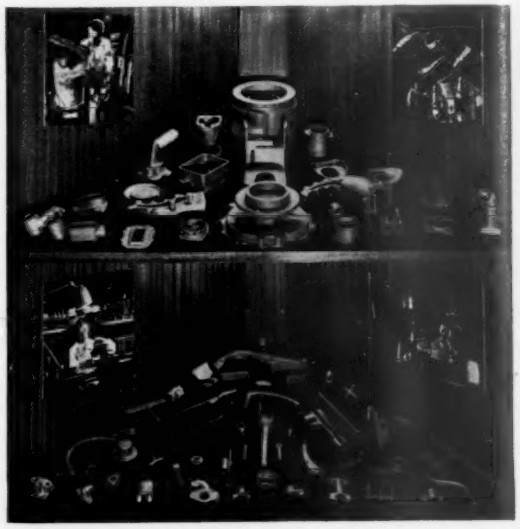
Standard Telephones and Cables, Ltd. (148, 149, 150 and 151 and O.D.S. F). Four new items of equipment: STR.23/34/35/36 comprehensive VHF/ILS/VOR airborne communication and navigation equipment; S.A.10 audio control and intercom. unit; sub-miniature radio altimeter and four-channel MF airborne radio teleprinter incorporating transistors and printed circuit techniques. Commutated antenna D/F; retransmission systems; various S.T.C. components.

Steel, Peech and Tozer, Ltd. (97). Rolled-steel rings for gas-turbine aero-engines; forged steel rings for aircraft disc-brake assemblies.

Sterling Metals, Ltd. (10). Castings in magnesium zirconium alloy series and in aluminium alloys. Display of small castings in aluminium and magnesium alloys manufactured by gravity, die and precision mould processes.

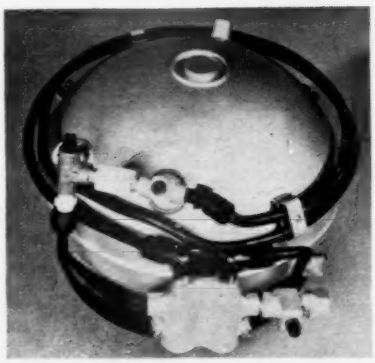
J. Stone and Co. (Charlton), Ltd. (95). A new magnesium alloy, MRS alloy, with properties exceeding those of previous types. Range of light-alloy castings in magnesium and aluminium alloys. The company has recently introduced a new type of aircraft ladder, the Airscalator, for attachment to aircraft doorways.

J. Stone and Co. (Deptford), Ltd. (94). Display of light-alloy and other non-ferrous rivets, washers and other fasteners; automatic voltage-regulators of the sealed type; Stone-Vapor thermostatic temperature controls and relays, as for the Viscount.



Right, specimens of small components produced by the Napier-cast method of high precision investment casting. Items can now be cast in the majority of alloy steels, including stainless, heat-resisting and high-speed groups.

Below, a 3½-litre Normalair stainless steel liquid oxygen converter. Weighing 16lb. when fully charged, it has an overall height of 8 in.



Suntex Safety Glass Industries, Ltd. (50). Perspex cabin windows; canopy mouldings; bullet-proof glass windscreens; rigid P.V.C. moulded panels; and clear acrylic tubing.

Super Oil Seals and Gaskets, Ltd. (142). Aeroquip flexible hose lines with detachable re-usable fittings; H.T.P. high-temperature polymer hose assemblies; Superfect oil seals and hydraulic packings; Romet diaphragm face seals; Redcaps polythene protective caps and plugs.

Talbot Stead Tube Co., Ltd. (241). Stainless heat-resisting seamless steel tube in straight and manipulated forms; small machined parts; bright-drawn turned and ground steel.

Tecalemit, Ltd. (282 and O.D.S. L). Low-pressure fuel filters; hydraulic and water-methanol filters; selection of lubrication equipment; examples of fire-fighting equipment manufactured by Foamite, Ltd.; range of Waveflex flexible waveguides for radar equipment.

Teddington Aircraft Controls, Ltd. (37). Temperature controllers; ice-detection and ice-indicating equipment; time switches; navigational light flasher units; fuel-tank pressurization units and pneumatic components.

Teleflex Products, Ltd. (163). SAF-T-MATIC inertia-lock shoulder harness and lap-strap for aircrew; cable-tension regulators and cable system accessories; Teleflex remote control with P.T.F.E.-lined conduits which reduce system friction.

The Telegraph Construction and Maintenance Co., Ltd. (112). Range of gas-free controlled expansion alloys; Telcon range of soft magnetic alloys; examples of miniature aircraft cables and airfield cables; specialized thermoplastic mouldings.

Thermal Control Co., Ltd. (144). Makers of Firetec aircraft fire-detection equipment and various pressure-operated switches for fuel systems and hydraulic systems.

(*Continued on page* 339)

The Marconi type SD.1000 four-position 15 in. radar display console. One of the series of fixed coil displays for radar systems developed by the company, it can be seen in a special outside pavilion containing an air traffic control exhibit.

Guide to the Stands . . .

(*Continued from page* 338)

Thermionic Products, Ltd. (15). Mk. 12 version of 14-channel recorder, which will record for 16 hr. without attention.

Thermo Plastics, Ltd. (275). Cockpit canopy and windscreen sidepanels for the Hunter; wing-tip for the Twin Pioneer.

Thorn Electrical Industries, Ltd. (129). Plastek panels and other flight-deck illumination systems; range of passenger-facility panels, roof cabin lights and warning signs; electrical connectors and other units.

Tiltman Langley, Ltd. (265). Test consoles and test equipment for checking main aircraft services; other made-to-order test units.

Titanine, Ltd. (164). Aircraft paints and finishes for high-speed flight; temporary protective treatments for aluminium sheets and protective paints for use during contour etching.

Triplex Safety Glass Co., Ltd. (5). A Javelin windscreen fitted with Triplex gold-film heating; Comet 4 and Vanguard screens with gold-film heating; reinforced screens; and curved laminated screens.

Above, a 40/80 kW aircraft ground starting and servicing trolley produced by Vernons Industries, Ltd.

Left, a new range of AC switchgear has been developed by Rotax and includes this 208 V., 3-phase, 400 c.p.s. mechanically latched trip-free contactor. It incorporates two pairs of auxiliary contacts, one pair normally open and one pair normally closed.

Vactric (Control Equipment), Ltd. (74) and **Vactric (Precision Tools), Ltd.** (75). Producers of telemetry switches for guided weapons; "breadboard" components for constructing servo systems; servo gearheads and speed reducers; DC servo components.

Valay Industries, Ltd. (138). Aircraft cleaning products including Aerowax high-gloss protection, Aerowash wash-down additive and Aeroval interior cleaner.

L.M. Van Moppes and Sons (Diamond Tools), Ltd. (266). Diaform attachments and Diamesh block for fir-tree blade root forming; Diatube equipment for runway testing and installation work; Diatorc and Diathread equipment.

Venner, Ltd. (12). Aircraft instruments including time delay switches, emergency lighting units, time and frequency-measuring equipment, and electronic flasher for navigation lights.

Venner Accumulators, Ltd. (11). Lightweight silver-zinc accumulators for aircraft and guided weapons. Type HT 125 shown for first time.

Vernons Industries, Ltd. (110 and O.D.S. 13). A 40/80 kW aircraft ground servicing trolley; range of special-purpose electrical equipment.

Ronald Trist and Co., Ltd. (21). Manufacturers of natural and synthetic rubber seals for hydraulic jacks, flying controls and hollow-section endless sealing rings.

Tubes, Ltd. (255). Tubular or hollow forgings for aircraft components including compressors and turbine shafts, landing gear axles, cylinder liners and guided missiles.

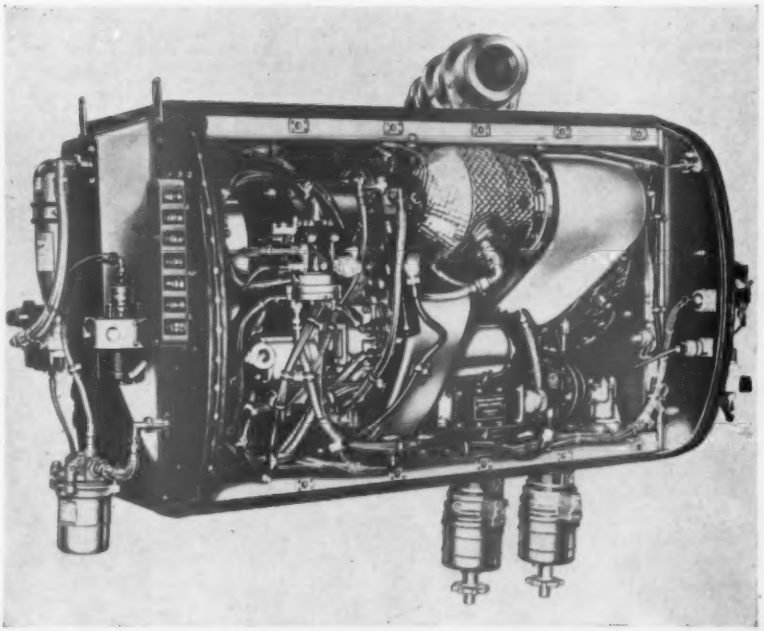
Tufnol, Ltd. (57). Aircraft components and production equipment manufactured from Tufnol; examples of Tufnol in its basic forms of sheet, tube and rod.

The Tungum Co., Ltd. (261). Components for guided weapons and radar equipment; springs, spinnings and machined parts.

Turner Brothers Asbestos Co., Ltd. (88). Large and small aircraft components moulded in asbestos-reinforced and glass-fibre-reinforced plastics.

Turner Manufacturing Co., Ltd. (103). Manufacturers of oleo compression legs; jacks, retracting mechanisms; vacuum and hydraulic pumps; flying controls.

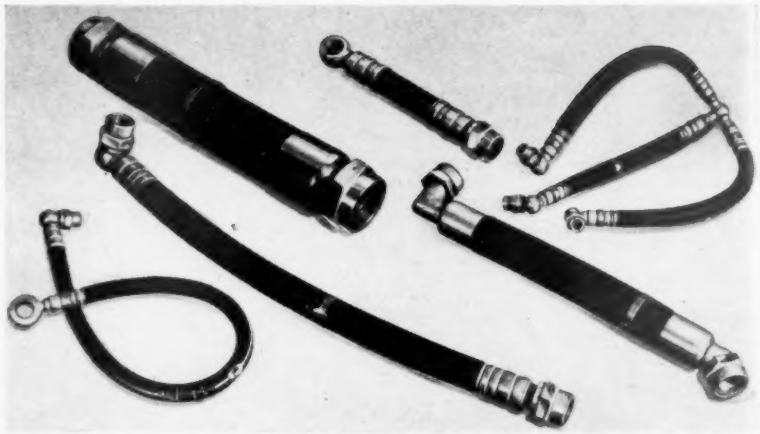
Ultra Electric, Ltd. (232). Makers of the SARAH system; transistorized intercom. equipment; a fast-response engine temperature-control and an altitude-compensated speed-control.



The Rover airborne auxiliary power plant for emergency electrical power or an independent supply of compressed air for main engine starting.

Guide to the Stands . . . .

Right, Palmer Silvoflex type 200 hose units for hydraulic systems.



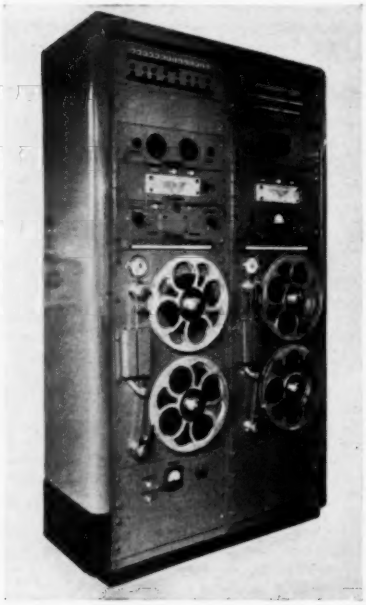
W. Vinten, Ltd. (118). Various marks of 16-mm. scientific and high-speed cameras; the 16-mm. G90 aircraft camera; and a 70-mm. reconnaissance camera.

Vokes, Ltd. (188). Equipment used in fuelling operations. Range of bulk fuel filters and a fuel monitor.

Waymouth Gauges and Instruments, Ltd. (2). See Smiths Aircraft Instruments, Ltd.

Wayne Kerr Laboratories, Ltd. (39). Demonstration of new vibration meter for measuring and monitoring vibrations; new electronic micrometer used to measure linear expansion of glasses and metals, and axial displacement of thrust races under load.

Wayne Tank and Pump Co., Ltd. (209). Producers of storage, pumping and measuring equipment for the high-speed refuelling of aircraft. Hydrant refuelling units; fluid meters; Viking pump unit for viscous fluids; high-lift self-priming unit for light distillates.



The Mk. 12 Thermionic Products 14-channel recorder which is designed to record for 16 hr. without attention.

Wellworthy, Ltd. (169). Metallic seals for pneumatic and hydraulic components; range of Spirolox retaining rings; Al-Fin process for the molecular bonding of aluminium alloy to ferrous material; pistons and piston rings; die castings.

Western Manufacturing (Reading), Ltd. (183). Selection of mechanical, electrical, electronic, hydraulic, pneumatic and thermal products; crew seats and various examples of presswork and metal fabrication.

Westinghouse Brake and Signal Co., Ltd. (211). Selenium rectifiers for aircraft power supplies; copper-oxide units for instrumentation; germanium and silicone diodes; selenium and germanium rectifier equipment.

Whitehouse Industries, Ltd. (143). Complete range of Philidas self-locking nuts of turret and industrial types; single- and double-anchor assembly nuts.

Henry Wiggin and Co., Ltd. (20). Turbine blades and flame-tubes of Nimonic high-temperature alloys which have completed several thousand running hours in Rolls-Royce Dart engines.

Williamson Manufacturing Co., Ltd. (56). Cameras used on recent aerial surveys including the F49 camera as used during the Falkland Islands and Dependencies Aerial Survey Expedition, and the specially adapted F24 camera used on the recent Antarctic crossing. The F117 hand-held air camera for maritime reconnaissance, air-sea rescue records and tactical oblique photography.

Wilmot Breeden, Ltd. (82). Hollow guide vanes and blades; engine starter fairings; precision-machined assemblies; de-icing and anti-icing units; fuel valves and controls.

Wireless Telephone Co., Ltd. (48). See The Plessey Co., Ltd.

Xetal Products, Ltd. (45). Manufacturers of rubberized hair to M.o.S. specifications in moulded or sheet form as protective packing for electronic and other equipment; parachute-cushion inserts and seat backs.

Zwicky, Ltd. (284 and O.D.S. N). Makers of mobile refuelling units for airports, ring-main pressure controllers, refuelling nozzles, floating suction heads, various types of filters and runway sweeper/collector units.

Above, a Bristol Olympus air intake in magnesium zirconium alloy manufactured by Sterling Metals Ltd. It has a diameter of 36 in. and weighs 193 lb.

W. H. Sanders (Electronics) Ltd., made this microwave analytical test bench for educational purposes.

TRADE DIRECTORY SECTION

INDEX

A
abrasives 4
absorption dryers 4
accelerometers 6
access doors 3
accessories 3
accumulators 5
accumulators (electric) 7
adhesive coatings 2
adjustable cable 3
aerodrome signalling 10
aerodrome machinery 10
air and oxygen exhausters 4
air compressors 4
air hoists 4
air motors 4
air pressure pumps 5
air/sea rescue equipment 8
aircraft clocks 9
aircraft control surfaces 3
aircraft instruments 6
aircraft locks, fastenings 5
aircraft safety equipment 8
aircraft starting units 10
aircraft upholstery 2, 9
airfield constructors 10
airfield lighting equipment 10
airframe components 3
airport equipment 10
airscrew blades 2
alignment telescopes 4
alternators 7
aluminium finishes 12
ammunition boxes and chutes 3
ancillary equipment 4
anodizing 3
anti-dermatitis creams 12
anti-friction metal 1
anti-vibration mountings 3
appliances 7
armaments 9
A.S.I. pressure heads 6
assembly fixtures 4
assembly platforms 10
assemblies 3
auto-standby generators 10
auto-transformers 7
auxiliary power units 10

B
backstand idlers 4
ball journals 4
band packings 3
banner and drogue targets 9
barrel finishing equipment 4
beacons 10
bearings (ball and roller) 3
beds 9
bellows-type joints 4
bent wire work 3
beryllium copper springs 3
big-end bearings 3
bi-metal brake drums 3
bitumen asbestos compound 2
blind flying instruments 6
blowers 10
bolts 3
bonded rubber-to-metal 3
bowsers 10
build-up equipment 12
building (insula'n) boards 2
bunks 9
bunsen burners 4
butting connectors 3

C
cabin lamps 7
cables 7
cable armouring 4
cable markers 3
cadmium plating 12
camshafts 3
carbon brushes and contacts 2
castors 3
cathode-ray recorders 6
cathode-ray tubes 7
cellulose and masking tapes 2
centralized lubrication 4
chairs 9
chemical brightening 12
chemical plant ware 3
circlips 3
clamps 4
cleats 3
cloths 9
clutches 3
coated abrasives 2
co-axial cables 3
cockpit ventilators 3
coil-winding machines 7
collapsible gates 10
components 3
compressed air equipm't 4
compressors 4
containers 3
conveyors 4
cooling air manifolds 3
corrosion-resistant ware 3
cork jointing 2
counters, electric, etc. 4, 6
couplings 3
covers 10
cowls and cowlings 3
crack-detecting ink 4
crankshaft 3
crash rescue tenders 8
crucibles 4
cutting oils 11
cylinder liners 3

D
degreasing compound 12
de-icing equipment 3, 5
de-salting kits 10
desiccators 4
detuners for silencing 9
die-casting machines 4
dies and die-sinking m/cs 4
dinghies 8
doors 10
drills, drilling machines 4
drinking water filters 10
dynamic balancing eq'm't 4

E
ear defenders 7
easing oil 12
ebonite panelling and doors 2
electric cable 3
electric motors 5
electrical comparators 4
electrical components 6
electrical equipment 7
electro-brightening 12
electro-mech. mechanisms 5
electronic equipment 7
eliminators 5
emergency generating plant 10
emergency lighting units 7
end fittings 3
engine components 1, 3, 4
engine-mounting systems 3
engine speed indicators 5
engine stands 4
engineers' tools 4
erection, repair, maintenance (buildings) 10
exhausters 4
exhausters for high-altitude testing 3
export packagings 9
extreme viscosity comp'ds 11

F
fair-leads 3
fasteners 3
fibre-glass moulding 3
filler caps 3
fire-fighting equipment 10
fire floats 8
firewall units 3
fittings 3
fixtures 3
flame traps 5
flares 10
flexible metal bellows 3
flexible shaft assemblies 5
flexible shaft machines 4
flight guides 9
flight test equipment 6
flood-lighting equipment 7
flow control valves 5
flow meters 6
fluid-sealing units 3
fluxes 1
flying clothing 8
flying controls 5
foam pumps 10
fork-lift trucks 10
forming and coiling 3
fractional h.p. motors 5
fuel-gauge test consoles 4
fuel measuring equipment 4
fuel pumps 5
fuel systems 5
furnaces 4

G
gantry cranes 4
gaskets 3
gauges 4, 6
gear-cutting plant 4
gear pumps 3
gears, gearboxes 3, 7
generator test benches 7
glass fabric facings 2
glazed assemblies 3
glove boxes 4
gloves 8
glues, synthetic 2
goggles 8
governors 3
greases 11
grinding wheels 4
ground starting units 10
gusseted bags 4
gyros, gyro instruments 6

H
hacksaws, blades 4
hammer switches 7
hand tools 4
hangars, Nissen, etc. 10
hard-surfacing processes 12
hardwoods 2
heat-exchangers 3
heat-treatment furnaces 4
heating ventilat'g equipm't 10
heat-treatment oils, salts 11
helicopter blades 2
hermetic seals 3
high-altitude brushes 3
high-precision machining 3
high-speed cutters 4
high-speed models 9
high-temperature coatings 2
hoisting gear 4
hoodings 3
hose 3, 4
H.T.P. fuels 11
hydraulic jacks 4
hydraulic pumps 5
hydraulic test gear 4

I
industrial lighting units 4
industrial trucks 10
injection-moulding m/cs 4
inspection equipment 4
instrument panels 3
instruments 6
insulated equipment 5
insulating materials 2
insulation materials 9
inverted testers 7

J
jacks 5
jet-calibrating machines 4
jet-pipe assemblies 3
jigs 3
joints 3
jubilee clips 3

K
kapok cushions 9

L
laboratory equipment 4
labyrinth seals 3
lapping machines, media 3, 12
life-saving equipment 8
light pressings 3
lighting equipment 7, 10
liquid oxygen 11
lock washers 3
lubricants 11
lubrication equip. and tools 3

M
machine parts 1
machine tools (all types) 4
magnetic monitoring 7
maintenance docks 10
manometers 9
maps and map mountings 9
marker lights 7
measuring equipment 6
measuring machines 4
mechanical cloths 9
mechanical handling gear 3
mechanical seals 3
metals—all forms 2
metal-forming equipment 4
metal polishing 12
metal spraying plant 4, 12
metal stamping 4
metal-working oils 11
meters 5
microscopes 6
mobile cranes 4
mobile fuellers 10
motors 5
mouldings, moulding powder 2
mountings 3
multichannel recorders 7

N
nameplates, machines 4, 9
navigational equipment 6, 7
navigators' tables, seats 9
nitrogen reducing valves 5
noise mufflers 9

O
oils 11
oil dispenser units 10
oil-resisting jointings 2
oil coolers 3
oil seals 3
operating boxes 3
optical inspection projectors 3
optical measuring instruments 6
overhauls and modifications 9
oxy-acetylene equipment 4
oxygen equipment 8

P
paint removers 12
paints 12
pallet transformers 10
panel beating 3
paper base laminated sheets 2
parachutes 8
passenger seats 8
passenger steps 10
permanent magnets 4
peroxy compounds 11
pest control 9
photo-copying materials 9
photographic materials 9
phosphate paint bonding 12
pins 3
pipe couplings 3, 5
pistons, piston-rings 3
plastic components 3
plastic materials, cements 2
plastic punkah louvres 9
plastic spraying 4
platform trucks 10
plugs 7
plywoods 2
pneumatic tools 4
polishers 4
polythene film 4
polythene piping, etc. 3
pop and cup rivets 3
portable tools 4
potentiometers 7
powerplant stands 4
power presses 4
precision chains 3
precision components 3
precision crimping 3
press tools 4
pressure control equipment 5
pressure test units 10
pressure transducers 6
pressurized assembly cabinets 4
profile projectors 4
proofed fabrics 2
protective clothing 10
prototype experimental work 9
public address systems 10
pulleys and rollers 3
pumping equipment 5
pumps 3, 10
P.V.C. insulated wire 3

Q
quick-release lashing 9

R
radar equipment, installations 7
radiators 3
radio equipment 7
reducing valves 6
refractories 4
refuelling equipment 5, 10
regulators 4
remote controlling gear 3, 5
research equipment 6
resistance welding 3
retaining rings 3
revolution indicators 6
riveting clamps 4
rivets 3
rocket-fuel oxidant 11
rotary wire and fibre brushes 4
rubber press tools 4
rubber, synthetic and natural 2
runways 10
rust preventatives 12

S
salts 4
sanders 4
sandwich panels 2
scientific instruments 6
screwdrivers 4
screws 3
screw thread inserts 3
sealing compound 2
seals 3
seaplane tenders 8
sections and turned parts 3
self-adhesive tapes 2
self-sealing couplings 3
self-sealing tank coverings 3
semi-fabricated components 3
separators 3
servo amplifiers 5
servo units 5
sheet metal assemblies 3
shot-blasting metal 4
silicon carbide elements 2
sleeves 3
small bench power presses 4
socket and ring wrenches 4
soldering equipment 4
solderless terminals 3
solders 1
solder tags 3
solenoids 6
sound insulators 7
sound measuring equipment 4
soundproofing 9
sound-proofing blankets 2
special-process machines 4
spinning 3
sprayers 10
spray-painting equipment 4
springs 3
spring washers 3
stacking seats 9
static dischargers 5
steel balls 3
steel storage equipment 4
stiffening bands 3
strainers 5
strain measuring instruments 6
stressed-skin structures 3
stretchers 8
sub-assemblies 3
surface-broach machines 4
survival equipment 8
swaged and spliced steel cable 3
switches 3, 7

T
tables 9
tanks 3
tape and wire recorders 9
tappers 3
target conversions 9
telecommunications 7
temperature indicators 7
templates 4
terminals 3
test and control gear 6
test equipment 5
test rigs 5
test sets 7
test-bed installations 4
thermal insulation blankets 2
thermo-plastic materials 2
thread grinders 4
thread milling hobs 4
thin-wall bushings, thrust washers 3
timing injection units 7
toilet units 9
tool grinding machines 4
tool steels 1
tools 3, 4
torsion-hinge assemblies 3
tractors 10
trailers 10
trimming and slitting gear 4
tripod jacks 4
trucks 10
tube lock nuts 3
tube-bending machines 4
turbine blades 1
tyre valves 4

U
ultrasonic thickness gauges 4
uniform cloths 2
unions 3
universal joints 3
upholstery 9

V
v-belts 4
vacuum cleaners 10
vacuum instruments 6
vacuum pumps 4
valves and filters 5
valves (radio and radar) 7
varnishes 12
veneers 2
Very cartridges 10
V.H.F. communications 7
vibration instruments 6

W
washers 3
water separators 9
weighing machines 4
welding equipment 4
welding rods 1
wheel chocks, stands, jacks 10
windows 3
windscreen wipers 3
wind speed indicators 10
wind-tunnel balances 9
wire-thread inserts 3
wire-wound potentiometers 7
wool and hair felt 9
worm reducers 3

This directory of non-exhibitors follows the guide to the stands at the S.B.A.C. Show. The names are grouped in twelve sections. The index above lists some 500 products followed by the number of the section in which the names of suppliers will be found.

(1) BASIC METALLIC MATERIALS (castings, forgings, sheets, stampings, all metals in unmachined state); (2) NON-METALLIC MATERIALS (adhesives, ceramics, glass fabrics, plastics, rubber, timber); (3) PREFABRICATED COMPONENTS AND PARTS (A.G.S. parts, airframe components, sub-assemblies); (4) TOOLS AND WORKSHOP EQUIPMENT (fixtures, hand and power tools, jigs, machine tools, measuring equipment, storage equipment); (5) CONTROLS, SYSTEMS AND ACCESSORIES.

(6) INSTRUMENT EQUIPMENT; (7) RADIO AND ELECTRICAL EQUIPMENT (includes navigational aids and communications); (8) SURVIVAL EQUIPMENT AND FLYING-CLOTHING; (9) MISCELLANEOUS EQUIPMENT AND SERVICES (furnishings, maps, packing, photographic supplies, repair work, research work, seating); (10) AIRPORT CONSTRUCTION AND EQUIPMENT (airfield lighting, fire-fighting, fork-lift trucks, ground power units, passenger steps); (11) FUELS AND OILS; (12) PAINTS, CLEANERS AND FINISHING PROCESSES.

Trade Directory . . . .

1 — *Basic Metallic Materials*

Aeroplane and Motor Aluminium Castings, Ltd., Wood Lane, Erdington, Birmingham. T.: Erdington 2207-9. Pressure, gravity and sand castings.

Aircraft Engineering and Jigs, Ltd., Wren Works, Chadderton, Lancs. T.: Chadderton 5691. Ferrous and non-ferrous castings.

Albion Drop Forgings Co., Ltd., Foleshill, Coventry. T.: Coventry 88091-3. Forgings, stampings.

Aluminium Corporation, Ltd., 30 Charles II Street, London, S.W.1. T.: Trafalgar 3104. Aluminium sheets, strip and circles.

Andrews Toledo, Ltd., Neepsend Lane, Sheffield, 3. T.: Sheffield 23274. Aircraft steels.

Balfour, Arthur, and Co., Ltd., Capital Steel Works, Sheffield, 3. T.: Sheffield 22071. High-speed, alloy tool and plain carbon tool steels.

Birkett, T. M., Billington and Newton, Ltd., Birkett St., Hanley, Stoke-on-Trent. T.: Stoke-on-Trent 22184. Non-ferrous castings and machine parts; Birso chill-cast rods and tubes.

Bolton, Thomas, and Sons, Ltd., Mersey Copper Works, Widnes, Lancs. T.: Widnes 2022. Aluminium, aluminium-nickel, bronzes; engine components; hot stampings and pressings, etc.

Bramah, J. R., and Co., Ltd., Devonshire St., Sheffield, 3. T.: Sheffield 24228. Aluminium alloy; Nimonic, etc., fabrications; Argon welding, etc.

Britannia Tube Co., Ltd., The, Glover St., Birmingham. Aluminium and alloy tubes and sections.

B.S.A., Ltd., Small Heath, Birmingham. T.: Victoria 2381. Forgings and stampings; gas-turbine blades.

Carlisle, C. G., and Co., Ltd., Iona Steel Works, 629 Penistone Rd., Sheffield, 6. T.: Sheffield 43615 and 43796. Stainless-steel bars.

Clifford, Charles, Ltd., Dogpool Mills, Birmingham, 30. T.: Selly Oak 1544. Non-ferrous metals. Phosphor-bronze, aluminium bronze. Brass and copper sheet and strip, tubes, etc.

Coley, R. J., and Son (Hounslow), Ltd., Jubilee Works, Chapel Rd., Hounslow, Middx. T.: Hounslow 2266. Metal merchants.

Dale, John, Ltd., London Colney, Herts. T.: Bowmansgreen 2266. Aluminium alloy castings.

Darwins, Ltd., Tinsley, Sheffield, 9. T.: Sheffield 31341. Alloy castings, etc.; alloy tool and high-speed steel.

Darwins Bright Steels, Ltd., Fitzwilliam Works, Tinsley, Sheffield, 9. T.: Sheffield 41341. Steel bars.

Deritend Stamping Co., Ltd., Liverpool St., Deritend, Birmingham, 9. T.: Victoria 2941-5. Forgings and stampings.

Diecastings, Ltd., Highgate Sq., Birmingham, 12. T.: Calthorpe 2241-3. Gravity, die and sand castings.

Doncaster, Daniel, and Sons, Ltd., 284 Penistone Rd., Sheffield, 6. T.: Sheffield 43081. Forgings; turbine blades, etc.

Dudley Drop Forging Co., Ltd., Holly Hall, Dudley, Worcs. T.: Brierley Hill 7561. Forgings.

Equator Wheels and Sections, Ltd., Raglan St., Wolverhampton. T.: Wolverhampton 21605. Stainless-steel stiffening bands. Cold rolling, forming, profiles, etc.

Fry's Metal Foundries, Ltd., Tandem Works, Merton Abbey, London, S.W.19. T.: Mitcham 4023. Solders and fluxes; Fryolux solder paint.

Hoyt Metal Co. of Great Britain, Ltd., Deodar Rd., Putney, London, S.W.15. T.: Vandyke 6061. Anti-friction metal specialists. Kirksite press tools.

Kayser, Ellison and Co., Ltd., Carlisle Steel Works, G.P.O. Box 144, Sheffield, 4. T.: Sheffield 22124. Kelock high-speed, tool, stainless, alloy, etc.

Kiveton Park Steel and Wire Works, Ltd., Kiveton Park, nr. Sheffield. T.: Kiveton 252. Steel bars.

Langley Alloys, Ltd., Langley, Slough, Bucks. T.: Langley 432. Hidurel 6 copper-based alloy; Hidurax aluminium bronze.

Lavender, J. H., and Co., Ltd., Hall Green Works, Crankhall Lane, West Bromwich. T.: Stone Cross 2273. Aluminium alloy castings.

Lee, Arthur, and Sons, Ltd., Trubrite Steel Works, Meadow Hall, nr. Sheffield. Bars, strip, etc.

Light-metal Forgings, Ltd., Churchbridge, Oldbury, nr. Birmingham. T.: Broadwell 1152 and 1895. Drop forgings and stampings.

Low Moor Alloy Steel Works, Ltd., The Steel Works, Low Moor, Bradford, Yorks. T.: Low Moor 663-5. Stainless steels.

Manganese Bronze and Brass Co., Ltd., The, 63 Grosvenor St., London, W.1. T.: Mayfair 3058. Wrought metals.

Mills, Exors. of James, Ltd., Bredbury St. Works, Woodley, nr. Stockport. Ledloy free-cutting steel, etc.

Mills, William, Ltd., Friar Park Rd., Wednesbury, Staffs. T.: Stonecross 2276-7-8. Castings.

Mining and Chemical Products, Ltd., 86 Strand, London, W.C.2. T.: Covent Garden 3393. Cerromatrix and Cerrotru fusible alloys; Cerrobend; MCP 15 Alloy.

Monk Bridge Iron and Steel Co., Ltd., Whitehall Rd., Leeds, 12. T.: Leeds 32066. Forgings; precision-forged turbine blades.

Morgan, George, Ltd., Selly Oak, Birmingham, 29. T.: Selly Oak 1156. Drop forgings.

Nitralloy, Ltd., Atlas Works, Sheffield, 4. T.: Sheffield 26646. Nitriding process of case-hardening special steels and Nitralloy steels.

Omes, Ltd., Beverley Works, Barnes, London, S.W.13. T.: Prospect 2291, and Poyle, Colnbrook, Bucks. Compressor and turbine-blade forgings, etc.

Osborn, Samuel, and Co., Ltd., Clyde Steel Works, Sheffield. Aircraft steels.

Perry Barr Metal Co., Ltd., Oscott and Queslett Works, Shady Lane, Gt. Barr, Birmingham, 22a. T.: Gt. Barr 1794. Light alloys.

Renfrew Foundries, Ltd., Hillington, Glasgow, S.W.2. T.: Halfway 3391. Alminal castings.

Rapp, Leo, Ltd. (inc. LR Airsteel, Ltd.), Wimborne Av., Norwood Green, Southall, Middx. T.: Southall 2322. Aluminium and aluminium-alloy sheet, bar, tube, etc.; stainless carbon and alloy steels to all specifications.

Rapp, Leo (Steel), Ltd., Wimborne Av., Norwood Green, Southall, Middx. T.: Southall 2322. Mild steel, sheets, plates and sections. Steels for jigging and tooling.

Rollet, H., and Co., Ltd., 6 Chesham Place, London, S.W.1. T.: Sloane 3463. Non-ferrous materials.

Samlesbury Engineering, Ltd., Samlesbury Airfield, nr. Blackburn, Lancs. T.: Blackburn 44668. Steel extrusions.

Sheepbridge Alloy Castings, Ltd., Hamilton Rd., Sutton-in-Ashfield, Notts. T.: Sutton-in-Ashfield 590. Alloy steel castings.

Sheffield Forge and Rolling Mills, Ltd., Millsands, Sheffield, 3. Aircraft steels.

Smethwick Drop Forgings, Ltd., Rolfe St., Smethwick. T.: Smethwick 1234. Drop forgings.

Smith-Clayton Forge, Ltd., Tower Works, Lincoln. T.: Lincoln 1251-2. Forgings and stampings.

Smith, Thomas, and Sons of Saltley, Ltd., Saltley Mill, Birmingham, 8. T.: East 0173. Drop forgings.

Steel Stampings, Ltd., Cooksley, nr. Kidderminster. T.: Wolverley 266. Pressings in stainless steel and other metals; welded rings.

Thomas, Richard, and Baldwins, Ltd., R.T.S.C. House, Park St., London, W.1. T.: Mayfair 8432; and Wern Works, Briton Ferry, Neath, Glam. T.: Briton Ferry 3211. Aluminium and light alloys.

Titanium Metal and Alloys, Ltd., 2 Metal Exchange Buildings, Leadenhall Avenue, London, E.C.3. T.: Mansion House 4521; and Clyde Steel Works, Sheffield, 2. Titanium rolled bar, forged blanks, rings and sheets.

Trucast, Ltd., Farnham Royal Lodge, Bucks. T.: Farnham Common 650. Investment castings, compressor and turbine blades.

United Steel Companies, Ltd., 17 Westbourne Rd., Sheffield, 10. T.: Sheffield 60081; and 8 Grosvenor Gardens, London, S.W.1. T.: Sloane 4533. Iron and steel plates, sections, forgings; alloy and special steels.

Vaughan Bros. (Drop Forgings), Ltd., Eagle Works, Willenhall, Staffs. T.: Willenhall 436-8. Drop forgings.

Wilson, W., and Sons (London), Ltd., 1-3 Chalfont Rd., London, N.7. Aluminium and aluminium alloys.

Yorkshire Copper Works, Ltd., The, P.O. Box 166, Stourton, Leeds. T.: Leeds 72222. Solid-drawn tubes. Yorkshire capillary fittings; Polyork plastic tube.

Yorkshire Engineering Supplies, Ltd., Upper Wortley Rd., Wortley, Leeds, 12. T.: Leeds 638234 and 638291. Eatonia and E.C.C. castings, etc.

Young, A. S., and Co., Ltd., Tower Works, Woodside Lane, London, N.12. T.: Hillside 6606-7. Welding rods and Colmonoy hard-surfacing alloys. Nicrobraz high-temperature brazing alloy.

2 — *Non-metallic materials*

Airpak, Ltd., 76 Grosvenor St., London, W.1. T.: Mayfair 3467. Tropal thermal insulation and sound-proofing blankets. Quilters of plastic and other materials.

Barbour, Wm., and Sons, Ltd., Hilden, Lisburn, N. Ireland. T.: Lisburn 2277. Linen thread, twines and cordage.

Birkbys, Ltd., Liversedge, Yorks. T.: Heckmondwike 514. Plastic mouldings, phenolic synthetic resins, cements. Friction materials.

British Artid Plastics, Ltd., 361-3 Buckingham Av., Trading Estate, Slough, Bucks. T.: Slough 25566. Mouldings and thermoplastic and thermosetting materials.

British Moulded Plastics, Ltd., Avenue Works, Walthamstow Av., London, E.4. T.: Larkswood 2323. Telenduron bitumen asbestos compound and mouldings; moulded plastics and extrusions.

British Nylon Spinners, Ltd., Pontypool, Mon. Nylon yarns.

British Resin Products, Ltd., Devonshire House, Piccadilly, London, W.1. T.: Mayfair 8867. Synthetic resins and plastics.

B.X. Plastics, Ltd., Higham Station Av., London, E.4. T.: Larkswood 5511. Sheets, rods, tubes, extrusions, foil, etc., in Cobex, Bexoid, Xylonite, B.X. P.V.C., B.X. Polystyrene, and Isoflex (thermal insulation).

Cape Asbestos Co., Ltd., 114 Park St., London, W.1. T.: Grosvenor 6022. Insulating materials, linings; building and insulation boards.

Cork Manufacturing Co., Ltd., Hall Lane, South Chingford, London, E.4. T.: Silverthorne 2666. Langite oil- and petrol-resisting jointings, anti-vibration strips; cork floats; laminated aluminium gaskets.

Daleman, Richard, Ltd., 325-327 Latimer Rd., London, W.10. T.: Ladbroke 3709. Evolite Perspex (acrylic) tubes and cylinders.

Expanded Rubber Co., Ltd., Mitcham Rd., Croydon, Surrey. Onazote expanded ebonite for panelling, doors, and as sandwich cores.

Ferodo, Ltd., Chapel-en-le-Frith, Stockport. T.: Chapel-en-le-Frith 2520. Friction materials.

Ferro Enamels, Ltd., Wombourne, Wolverhampton. T.: Wombourne 2281. High-temperature coatings, including Solaramic.

Gosheron, John, and Co., Ltd., Gayford Rd., London, W.12. T.: Shepherd's Bush 3326. Self-adhesive tapes.

Jones, Samuel, and Co., Ltd., New Bridge St., London, E.C.4. T.: Central 6500. Self-adhesive tapes.

Kautex, Ltd., Elstree Way, Elstree, Herts. T.: Elstree 1777-9. Synthetic and natural rubber mouldings; Neoprene bonded cork jointing.

Klinger, Richard, Ltd., Klingerit Works, Sidcup, Kent. T.: Foots Cray 7777. Klinger 721 oil-resistant compressed asbestos jointing.

Leicester, Lovell and Co., Ltd., North Baddesley, Southampton, Hants. T.: Rownhams 363. Casco, Casco resin, Cascamite and Cascophen synthetic-resin glues.

Mallinson, William, and Sons, Ltd., 130-150 Hackney Rd., London, E.2. T.: Shoreditch 7654. Hardwoods, veneers, plywoods, etc.

Mandleberg, J., and Co., Ltd., Albion Works, Cobden St., Pendleton, Salford 6, Lancs. T.: Pendleton 1441. Proofed fabrics for balloons, dinghies, flotation gear, inflatable chairs, aircraft covers, etc.

Minnesota Mining and Manufacturing Co., Ltd., Arden Rd., Adderley Park, Birmingham, 8. Scotch Boy cellulose and masking tapes, 3M adhesive coatings and sealers; 3M coated abrasives.

Morgan Crucible Co., Ltd., The, Battersea Church Rd., Battersea, London, S.W.11. T.: Battersea 8822. Morganite carbon and metal-graphite brushes and contacts. Crusilite silicon carbide electric-furnace elements. Carbon piles and electrodes.

Moulded Components (Jablo), Ltd., Mill Lane, Croydon, Surrey. T.: Croydon 2201. Airscrew and helicopter blades, etc. Sandwich panels with Aero Jablex core; glass-fabric facings; thermal and sound insulation.

Norbrac Carbon, Ltd., Commerce Way, Lancing, Sussex. T.: Lancing 2053. Specialist grade carbons.

North British Plastics, Ltd., Patterson St., Blaydon-on-Tyne. T.: Blaydon 346-9. Panax paper-base laminated sheets, etc.

Peradin and Watercraft, Ltd., Freshford, nr. Bath, Somerset. T.: Limpley Stoke 3263. Peratol sealing compound.

Rubbaglas, Ltd., 66 Victoria St., London, S.W.1. T.: Victoria 6501. Rubbaglex sheeting, etc.

Scott, Bader and Co., Ltd., Wollaston, Wellingborough, Northants. T.: Wollaston 262. Marco and Crystic polyester. Sebalkyd resin.

Siemens, Edison Swan, Ltd., 155 Charing Cross Rd., London, W.C.2. T.: Gerrard 8660. Plastic extrusions, fabrications, sheeting, mouldings, glass fibre, etc.

(*Continued on page* 343)

Trade Directory . . . .

(*Continued from page* 342)

Smith and Nephew, Ltd., Bessemer Rd., Welwyn Garden City, Herts. T.: Welwyn Garden City 5151. Lasso self-adhesive tapes.

Sorbo, Ltd., Woking, Surrey. T.: Woking 966. Rubber goods.

Surridge's Patents, Ltd., New Works, Croydon Rd., Elmers End, Beckenham, Kent. T.: Beckenham 0168 and 1313. Titebond adhesives.

Tinkertex, Ltd., Bottoms Mill, Holmfirth, nr. Huddersfield. T.: Holmfirth 636. Aircraft upholstery cloth and curtaining. Uniform cloths.

Wallington, Weston and Co., Ltd. (Inc. Frome Plastics, Ltd.), Vallis Mills, Frome, Somerset. T.: Frome 2206. Hibudine seals and gaskets. Fromoplas plastic sheets, mouldings and moulding powder. Flexlite sponge rubber.

Warerite, Ltd. (unit of Bakelite, Ltd.), Watton Rd., Ware, Herts. Decorative laminated plastics.

Wright, John, and Sons (Veneers), Ltd., Avon Wharf, Longfellow Rd., Mile End Rd., London, E.3. T.: Advance 4444. British-cut veneers for construction and decoration.

3 — *Prefabricated Components and Parts*

Abbey Panel and Sheet Metal Co., Ltd., Old Church Rd., Coventry. T.: Coventry 89461. Aircraft fabrications, cowls and assemblies.

Aeriec (Aluminium), Ltd., Stoke Prior, nr. Bromsgrove, Worcs. T.: Bromsgrove 2791-2. Semi-fabricated aluminium components. Light-alloy materials.

Aerocontacts, Ltd., Gatwick Airport, Horley, Surrey. T.: Horley 1510. A.G.S. parts, accessories and components.

Aerolex, Ltd., Bridge Rd., Camberley, Surrey. T.: Camberley 1500. Components and assemblies.

Aeroparts Engineering Co., Ltd., Commercial Rd., Hereford. T.: Hereford 3068. Assemblies and components; lubrication equipment and tools.

Aircraft Engineering and Jigs, Ltd., Wren Works, Chadderton, Lancs. T.: Chadderton 5691. Aircraft components.

Aircraft-Marine Products (Gt. Britain), Ltd., 60 Kingly St., London, W.1 T.: Regent 2517-8. Solderless terminals and connectors; precision crimping.

Amal, Ltd., Holdford Rd., Witton, Birmingham, 6. T.: Birchfields 4571. Ball and roller joints; cowling fasteners.

Angus, George, and Co., Ltd., Coast Rd., Wallsend, Northumberland. T.: Wallsend 64551. Fluid-sealing units; Gaco M.I. oil seals, O-rings, gaskets, tubing, etc.

Arens Controls, Ltd., Tunstall Rd., East Croydon, Surrey. T.: Addiscombe 3051. Remote controlling gear; operating boxes; end fittings.

Armstrong Patents Co., Ltd., Eastgate, Beverley, Yorks. Heli-coil screw thread inserts and high-endurance nuts.

Aston, E. S., and Co., Ltd., 5 Sebastian St., Goswell Rd., London, E.C.1. T.: Clerkenwell 2179. Instrument panels; cleats; fair-leads; packings and control knobs in laminated plastics and cast resins.

Auster, Ltd., Crown Works, Barford St., Birmingham, 5. T.: Midland 2123. Glazed assemblies; cockpit ventilators, etc. Machining and mechanical assemblies.

Autoset (Production), Ltd., Stour St., Birmingham, 18. T.: Edgbaston 1143-4. Springs and rubber-suspension equalizing castors; fixed-direction wheel brackets; castors.

Avery Equipment, Ltd., Tachbrook Rd., Leamington Spa. T.: Leamington Spa 2700. Flexible hose and self-sealing couplings.

Aviation Traders, Ltd., 21 Wigmore St., London, W.1. T.: Museum 7791; Southend Airport, Essex. T.: Rochford 56491; and Stansted Airport, Essex. T.: Takeley 391. A.G.S. parts; major and sub-airframe assemblies; gas-turbine sheet-metalwork; tubular fabrications.

Barber and Colman, Ltd., Marsland Rd., Brooklands, Manchester. T.: Sale 2277. Shakeproof thread-cutting screws; lock washers.

Baxter's (Bolts, Screws and Rivets), Ltd., Parade Works, Sheepcote St., Birmingham, 15. T.: Midland 0105. Bolts and rivets.

Beckett, Laycock and Watkinson, Ltd., Acton Lane, Harlesden, London, N.W.10. T.: Elgar 5403. Glazed assemblies. Beclawat silent window channel.

B.M.B. (Sales), Ltd., 2 Balfour Place, Mount St., London, W.1. Steel bearings and balls. Miniature bearings.

Boosey and Hawkes (South Wales), Ltd., Dinas Isaf, Williamtown (Rhondda), Glamorgan. T.: Tonypandy 3365. Aeronautical engineers.

Borg and Beck Co., Ltd., Tachbrook Rd., Leamington Spa. T.: Leamington 2700. Clutches.

Bramah, J. R., and Co., Ltd., Devonshire St., Sheffield, 3. T.: Sheffield 24228. Aircraft tanks.

Brauer, F., Ltd., Grove Road, Harpenden, Herts. T.: Harpenden 3603. Toggle clamps.

British Piston Ring Co., Ltd., The, Brico Works, Holbrook Lane, Coventry. T.: Coventry 89014. Pistons, piston rings, cylinder liners, valve-seat inserts, tappets, etc.

British Timken, Ltd., Duston, Northampton. T.: Northampton 4921-8 and 3452-3. Tapered roller bearings, gearboxes, torsion-hinge assemblies and control mechanisms.

British Tyre and Rubber Co., Ltd., Herga House, Vincent Sq., London, S.W.1. T.: Victoria 3848. Rubber de-icing, seals, etc.

British Wire Products, Ltd., Worcester Rd., Stourport-on-Severn, Worcs. T.: Stourport 240. Controls and cables; Britloc wire rope slings, oil filters, pipe-bending, etc.

Brown, David, Gears (London), Ltd., Stonebridge Park Works, North Circular Rd., London, N.W.10. T.: Elgar 6824. Gears and gear units; Radicon worm reducers; gear pumps.

Brown, E. G., and Co., Ltd., West Rd., Northumberland Park, Tottenham, London, N.17. T.: Tottenham 2257. Airframe components. Pressings and stampings; tanks; ammunition boxes and chutes.

Burnley Aircraft Products, Ltd., Fulledge Works, Burnley. T.: Burnley 3121-2 and 3203. Jet-pipe assemblies, exhaust units, cooling-air manifolds, firewall units, expansion bellows, oil-tank units and insulation blankets, etc.

Carr Fastener Co., Ltd., Stapleford, Nottingham. T.: Sandiacre 3085. Fasteners.

Cathodeon, Ltd., Church St., Cambridge. T.: Cambridge 56481. Hermetic glass-to-metal seals.

Clayton-Wright, Howard, Ltd., Wellesbourne, Warwickshire. T.: Wellesbourne 316-7-8. Clatonrite self-sealing weatherstrip; Nylastic adjustable cable and Clatonrite anti-vibro cable support clips; Harrisflex anti-vibration mountings; Clayflex flexible bearings; Nylastic bearings; Clatonrite Stikastrip.

Corner, G., and Co., Ltd., Johnson Brook Rd., Hyde, Cheshire. T.: Hyde 633 and 1508. Sheet metal assemblies.

Coventry Climax Engines, Ltd., Widdrington Rd. Works, Coventry. T.: Coventry 5051. Accessories.

Crane Packing, Ltd., Slough, Bucks. T.: Slough 24031. Band packings and mechanical seals. Processors and fabricators of P.T.F.E. plastic.

Cross Manufacturing Co. (1938), Ltd., 33 Midford Rd., Combe Down, Bath. T.: Combe Down 2355. Spring washers, labyrinth seals, wire-thread inserts, springs, etc.

Curd Components, Ltd., 41 Lonsdale Rd., London, W.11. T.: Bayswater 0319 and 6866. Standard aircraft parts.

Davis and Timmins (Aircraft), Ltd., 270 High Rd., Ilford, Essex. T.: Ilford 3460. A.G.S. parts; screws, nuts, washers, bolts and fasteners.

Equator Wheels and Sections, Ltd., Raglan St., Wolverhampton. T.: Wolverhampton 21605-6. Stainless-steel stiffening bands for jet engines; cold rolling, forming and coiling in all metals; profile manipulations.

Fischer Bearings Co., Ltd., Upper Villiers St., Wolverhampton. T.: Wolverhampton 26101-8. Ball and parallel roller bearings.

Fletcher, C. W., and Sons, Ltd., Sterling Works, Arundel St., Sheffield, 1. T.: Sheffield 28049 and 28040. Precision sheet-metal work.

Flexello Castors and Wheels, Ltd., Trading Estate, Slough, Bucks. T.: Slough 24121. Wheels, castors and bearings.

Flexibox, Ltd., Nash Rd., Trafford Park, Manchester, 17. T.: Trafford Park 1477. Mechanical seals. Lapping machines. Cabin supercharge equipment.

Fox, C. J., and Sons, Ltd., 117 Victoria St., London, S.W.1. T.: Victoria 0204. Sole concessionaires for Kaylock locking nuts and fasteners.

Hardy Spicer, Ltd., Birch Rd., Witton, Birmingham, 6. T.: Birchfields 4504-9. Universal joints and cardan shafts.

Harper, C. E., Aircraft Co., Ltd., Exeter Airport, Clyst Honiton, Devon. T.: Exeter 67451. Components and sub-assemblies.

Harrington, Thomas, Ltd., Sackville Works, Old Shoreham Rd., Hove, Sussex. Components.

Henderson Safety Tank Co., Ltd., The, Elstree Way, Boreham Wood, Herts. T.: Elstree 1758-9 and 1917. Tanks; sections and turned parts.

Heston Aircraft and Associated Engineers, Ltd., Heston Airport, Hounslow, Middx. T.: Hayes 38441. Sub-assemblies and components; S.B.A.C. filler caps.

Hobourn Aero Components, Ltd., Strood, Rochester, Kent. T.: Strood 7626. Airframe and engine machined components.

Hoffmann Manufacturing Co., Ltd., The, Chelmsford, Essex. T.: Chelmsford 3151. Bearings for aircraft controls, helicopter rotor-heads, variable-pitch propellers, etc.

Houdaille Co., Ltd., The, 8-14 Hampton Rd., Twickenham, Middx. T.: Popesgrove 6284. Electrically operated windscreen wipers.

Jack, E. J., Ltd., 154 Camden High St., London, N.W.1. T.: Gulliver 5761. Fafnir and other American ball and roller bearings.

Lawrence, J. W., Ltd., Abbey Lane, Leicester. T.: Leicester 62441. Radiators, oil coolers and heat exchangers.

Leatern (Aircraft), Ltd., 122A-B Pentonville Rd., London, N.1. T.: Terminus 6368-9; and Main Rd., Hawkwell, Hockley, Essex. T.: Hockley 353. B.S.S., S.B.A.C. and A.G.S. bolts, nuts, pipe couplings, unions, etc.

Linread, Ltd., P.O. Box 21, Cox St., Birmingham, 3. T.: Central 3951. Aircraft bolts and screws to British, Unified and American (A.N.) standards; rivets; Rivnuts.

Manganese Bronze and Brass Co., Ltd., The, 63 Grosvenor St., London, W.1. T.: Mayfair 3058. Oilite self-lubricating bearings.

M.B. Metals, Ltd., Vale Works, Vale Rd., Portslade, Sussex. T.: Hove 48623-4. Switches and butting connectors.

Metalastik, Ltd., Evington Valley Rd., Leicester. T.: Leicester 37281. Rubber-to-metal weld anti-vibration devices; engine-mounting systems; mountings; couplings, undercarriage suspension, etc.

Middleton Sheet Metal Co., Ltd., Spring Vale Works, Middleton, Manchester. T.: Middleton 2427-8. Resistance welding; aircraft control surfaces, access doors, etc. Jet-engine canware; tanks and containers; glass-fibre plastic moulding.

Midland Aeroquipment, Ltd., Park Rd., Bloxwich, nr. Walsall, Staffs. T.: Bloxwich 66414. Aircraft locks and fastenings.

Moore's (Bournemouth), Ltd., Wallisdown Rd., Bournemouth. T.: Winton 5810. High-precision machining; prototype and assembly work; aircraft fabrications.

Mountford, Fredk., (Birmingham), Ltd., Fremo Works, Moseley St., Birmingham. T.: Midland 3488. A.G.S. parts; pins, etc.

Newall, A. P., and Co., Ltd., Possilpark, Glasgow, N. T.: Possil 8232. Newall Hitensile, Newalloy, Newallastic. Newall Hi-Tem heat-treated bolts.

Newman Industries, Ltd., Yate, Bristol. T.: Chipping Sodbury 3311. Electrical and mechanical engineers and manufacturers.

Newton, L. H., and Co., Ltd., Nechells, Birmingham, 7. T.: East 1551. Special precision components. Bolts, nuts, screws, rivets and washers. Capstan and automatic work. Light pressings; bent wire work; cold forged special work.

Nobrac Carbon, Ltd., Commerce Way, Lancing, Sussex. T.: Lancing 2053. Carbon brush seals; high-altitude brushes.

Northern Rubber Co., Ltd., Retford, Notts. T.: Retford 256. Nordoil synthetic rubber products. Gaskets, joints, hose, etc. Silastic products.

Northey Rotary Compressors, Ltd., Alder Rd., Parkstone, Dorset. T.: Parkstone 1500. Exhausters for high-altitude instrument testing.

Oddie Fasteners, Portswood Rd., Southampton. T.: Southampton 55883. Oddie fasteners, pins and solid-lock shear fasteners.

Opperman, S. E., Ltd., Stuart Works, Stirling Corner, Boreham Wood, Herts. T.: Elstree 2021. Aircraft components, gears and gearing, motor units and materials.

Parkes, L. B., and Co., 16 Station St., Walsall. T.: Walsall 4546. Anodizing and metal finishing; pressings and stampings. Crash and fire-proofing petrol and oil tanks.

Paul, W. H., Ltd., Breaston, Derby. T.: Draycott 354-5. Metal pressings.

Peradin and Watercraft, Ltd., Freshford, nr. Bath, Somerset. T.: Limpley Stole 3263. Precision moulded parts and bonded rubber-to-metal parts.

The ¼-in. bit model by Adcola Products, Ltd., for solder jointing of electronic circuits. It is manufactured to special requirements in all voltage ranges and temperatures. (See section 4.)

Trade Directory . . . .

Power Flexible Tubing Co., Ltd., The, Derby Works, Vale Rd., London, N.4. T.: Stamford Hill 6696. Flexible metal bellows; tubing and fittings.

Powis, D., and Sons, Ltd., Forward Works, Golden Hillock Rd., Sparkbrook, Birmingham, 11. T.: Victoria 1264. Light-alloy aircraft rivets and split cotter pins; beryllium copper crinkle washers.

Randall, James H., and Son, Ltd., Paddington Green Works, London, W.2. T.: Ambassador 1661. Sheet metal work. Spinning.

Ransome and Marles Bearing Co., Ltd., Stanley Works, Newark-on-Trent. T.: Newark 456-9. Bearings for engines, etc.

Renold Chains, Ltd., Renold House, Wythenshawe, Manchester. T.: Gatley 5221. Aircraft precision chains.

Richard, Alexander, and Co., Ltd., Craven House, Kingsway, London, W.C.2. T.: Holborn 6178. Aircraft materials and components.

Richards, Charles, and Sons, Ltd., Darlaston, nr. Wednesbury. T.: James Bridge 3188. Nuts and bolts.

Riley, Robert, Ltd., Milkstone Spring Works, Rochdale. T.: Rochdale 2237. Aircraft springs. Specialists in beryllium copper springs.

Robinson, I., and Co. (Gillingham), Ltd., 26 London Chambers, Gillingham, Kent. Jubilee clips.

Salisbury Precision Engineering, Ltd., Old Sarum Works, Castle Rd., Salisbury, Wilts. T.: Salisbury 4291. Airframe sections ground equipment, mechanical handling equipment; optical inspection projectors.

Salter, Geo., and Co., Ltd., West Bromwich. T.: West Bromwich 1855. Springs, roller bearings, circlips, retaining rings, fasteners. Grey-iron castings.

Samlesbury Engineering, Ltd., Samlesbury Airfield, nr. Blackburn, Lancs. T.: Blackburn 44668. Sub-assemblies, airframe components, oil coolers, machined parts, light-alloy sheet and plate; sheet metalwork.

Scottish Distributors, Ltd., Aeronautical and Scientific Division, 62 Shirland Rd., Maida Vale, London, W.9. T.: Cunningham 8080. A.G.S. parts, actuators and bearings.

Sheepbridge Alloy Castings, Ltd., Hamilton Rd., Sutton-in-Ashfield, Notts. T.: Sutton-in-Ashfield 590. Bi-metal brake drums.

Siegrist Orel, Ltd., 39 Berners St., London, W.1. T.: Museum 0032. Neoprene and latex sleeves and cable markers. Electrical instruments.

Simplifix Couplings, Ltd., Beacon Works, Hargrave Rd., Maidenhead, Berks. T.: Maidenhead 22714. Joints for copper tubes; cold-drawn steel and dural tubes, etc.

Skefco Ball Bearing Co., Ltd., The, Luton, Beds. T.: Luton 5700. Ball bearings, cylindrical, taper and spherical roller bearings; pulleys and rollers.

Stewart Aeronautical Supply Co., Ltd., Adastral House, Lowfield Heath, Crawley, Sussex. T.: Horley 4300. Aeronautical equipment, spares.

St. Helens Cable and Rubber Co., Ltd., St. Helens Works, Slough, Bucks. T.: Slough 20333. Electric cable and general rubber goods.

Stream-Line Filters, Ltd., Ingate Pl., London, S.W.8. T.: Macaulay 1011-3. Filters for aviation fuels; water separators.

Superflexit, Ltd., 118 Buckingham Av., Slough, Bucks. T.: Slough 24561. Non-metallic flexible tubing and hoses.

Sutherland, A. G., Ltd., Warwick Rd., Greet, Birmingham. T.: Victoria 2184. Sheet-metal work, light pressings, etc.

Taylor, C. F., (Metal Workers), Ltd., Molly Millars Lane, Wokingham, Berks. T.: Wokingham 1005-6. Sheet-metal work; coppersmiths; stressed-skin structures. Jigs, tools and fixtures. Glassfibre mouldings.

Tempered Spring Co., Ltd., The, Warren St., Sheffield, 4, Yorks. T.: Sheffield 21333. Springs.

Tenaplas (Sales), Ltd., 24-25 Manchester Sq., London, W.1. T.: Welbeck 7941. Co-axial cables, P.V.C. and polythene insulated wire, insulator sleevings, polythene waterpipe systems, chemical plant and corrosion-resistant ware; thermoplastic extrusions.

Terry, Herbert, and Sons, Ltd., Redditch, Worcs. T.: Redditch 61. Springs, presswork, wirework, hose clips, Anglepoise lamps, etc.

Torrington Co., Ltd., The, Torrington Av., Coventry. T.: Coventry 3132-6. Needle bearings; bolts and screws.

Tucker Eyelet Co., Geo., Ltd., Walsall Rd., Birmingham, 22. T.: Monarch 4811-5. Pop and cup rivets, solder tags, terminals, etc.

Turner and Savage, Ltd., 140 Willesden Lane, London, N.W.6. T.: Maida Vale 4881. Panel beaters and sheet-metal specialists.

United Steel Companies, Ltd., 17 Westbourne Rd., Sheffield, 10. T.: Sheffield 60081; and 8 Grosvenor Gardens, London, S.W.1. T.: Sloane 4533. Steel strip and wire.

Vandervell Products, Ltd., Western Av., London, W.3. T.: Acorn 2251. Thin-wall precision-finished crankshaft main and connecting-rod big-end bearings; thin-wall bushings and thrust washers.

Viscose Development Co., Ltd., 40 Chancery Lane, London, W.C.2. T.: Chancery 8111. Cable markers.

V.P. Sheet Metal, Ltd., 29 Windsor St., Cheltenham, Glos. T.: Cheltenham 5805. Sheet metal work and presswork; tanks; cowlings; jet pipes, etc.

Weathershields, Ltd., 48 Moor St., Birmingham. T.: Midland 2074. Hoodings and windows. Tube lock nuts.

Wells, A., and Co., Ltd., Stirling Rd., Walthamstow, London, E.17. T.: Larkswood 2691. Equiflex anti-vibration mountings.

Westminster Airways Servicing, Ltd., Priory Rd., Hardway, Gosport, Hants. T.: Gosport 88081-3. Aircraft machine parts; sub-assemblies.

Weston, Charles, and Co., Ltd., Irwell Bank Works, Douglas Green, Pendleton, Salford, 6. T.: Pendleton 2857-9. Oil seals and oil-sealing devices.

Weyburn Engineering Co., Ltd., Elstead, Surrey. T.: Elstead 2141. Precision engineers. Camshafts, governors, pumps, etc.

Wilkinson Rubber Linatex, Ltd., Frimley Rd., Camberley, Surrey. T.: Camberley 1595. Flexatex hose; self-sealing tank coverings; Linatex seals.

Williamson, W. and A., and Co., Ltd., Hook Rise, Kingston By-pass, Surbiton, Surrey. T.: Elmbridge 6484. Fuel and oil tanks; sheet-metal work.

Wokingham Plastics, Ltd., Denton Rd., Wokingham, Berks. T.: Wokingham 700. Plastic components, toilet and interior fittings.

Wrights' Ropes, Ltd., Universe Works, Birmingham, 9. T.: Victoria 1914. Swaged and spliced steel aircraft cables and assemblies.

Y.S.C., Ltd., The, 45-47 Copeland Rd., London, S.E.15. T.: New Cross 6113. A.G.S. spares; bolts, screws, etc.

4—*Tools and Workshop Equipment*

Abingdon King Dick, Ltd., Tyseley, Birmingham, 11. Hand tools for repair and maintenance.

Adcola Products, Ltd., Gauden Rd., London, S.W.4. T.: Macaulay 4272. Soldering instruments and equipment; solder jointing for radio and radar.

Aerocontacts (Ground Equipment), Ltd., Gatwick Airport, Horley, Surrey. T.: Horley 1510. Aero-engine stands and jacking equipment.

Aerograph Co., Ltd., 47 Holborn Viaduct, London, E.C.1. T.: City 4361. Spray-painting equipment.

Aerolux, Ltd., Camberley, Surrey. T.: Camberley 1500. Assemblies and tools.

Air Industrial Developments, Ltd., Aidspray Works, Shenstone, nr. Lichfield, Staffs. T.: Shenstone 341-5. Spray-painting and compressed-air equipment.

Portable electric tools by Black and Decker, Ltd., are in wide use in industry. Here a valve-seat grinder is shown.

Aircraft Engineering and Jigs, Ltd., Wren Works, Chadderton, Lancs. T.: Chadderton 5691. Jigs and tools.

Allied Electronics, Ltd., 28 Upper Richmond Rd., Putney, London S.W.15. T.: Vandyke 1856. Simmonds Pacitor fuel-gauge test console.

Amal, Ltd., Holdford Rd., Witton, Birmingham, 6. T.: Birchfields 4571. Jet-calibrating machines; Bunsen burners and injectors.

Archdale, James, and Co., Ltd., Ledsam St., Birmingham, 16. Milling and drilling machines, etc.

Asquith, Wm., Ltd., Halifax House, Strand, London, W.C.2. T.: Trafalgar 7224. Drilling and horizontal-boring machines.

Atkin, W. T., (Tottenham), Ltd., 178 St. Ann's Rd., Tottenham, London, N.15. T.: Stamford Hill 6686. Press toolmakers and metal stampers.

Autoset (Production), Ltd., Stour St., Birmingham, 18. T.: Edgbaston 1143-4. Ball journals; clamps.

Avery, W. and T., Ltd., Soho Foundry, Birmingham, 40. T.: Smethwick 1112. Weighing, counting, measuring and testing machines.

Aviation Traders, Ltd., 21 Wigmore St., London, W.1. T.: Museum 7791; Southend Airport, Essex. T.: Rochford 56491; and Stansted Airport, Essex. T.: Takeley 391. Engine stands and test-bed installations, jigs and fixtures.

Balfour, Arthur, and Co., Ltd., Capital Steel Works, Sheffield, 3. T.: Sheffield 22071. Engineers' small tools.

Bardolph, J. F., and Partners, Ltd., 1 Robert St., Adelphi, London, W.C.2. T.: Trafalgar 1927. Myers riveting clamps.

Beaton and Stone, Ltd., Enots Works, Aston Brook St., Birmingham, 6. T.: Aston Cross 1905. Centralized lubricating systems; machine-tool coolant fittings, etc.

Birlec, Ltd., Tyburn Rd., Erdington, Birmingham, 27. T.: East 1471. Furnaces for heat treatment and melting; absorption dryers.

Black and Decker, Ltd., Harmondsworth, Middx. T.: West Drayton 2681-9. Portable electric tools; heavy-duty holguns; screwdrivers; sanders, polishers and drills.

Brayshaw Furnaces and Tools, Ltd., Belle Vue Works, Manchester, 12. T.: East 1046. Furnaces; engineers' small tools.

Brooke Tool Manufacturing Co., Ltd., The, Warwick Rd., Greet, Birmingham, 11. T.: Victoria 2323. Engineers' small tools. Special cutters for Nimonic drill chucks, jigs and fixtures.

Broom and Wade, Ltd., High Wycombe, Bucks. T.: High Wycombe 1630. Air compressors and pneumatic tools.

Brown, David, and Sons (Huddersfield), Ltd., Park Works, Huddersfield, Yorks. T.: Huddersfield 3500. Gear-cutting plant and equipment; gears and gear units.

Brown, David, Industries, Ltd., Machine Tools Division, Britannia Works, Sherborne St., Manchester, 3. Machine tools.

Brown, David, Industries, Ltd., Tool Division, Park Works, Huddersfield, Yorks. Gear-cutting tools, jigs, fixtures, etc.

B.S.A. Tools, Ltd. (Sole Agents, Burton Griffiths and Co., Ltd.), Kitts Green, Birmingham, 13. T.: Victoria 2351 and 3071. Tools.

Burnley Aircraft Products, Ltd., Fulledge Works, Burnley, Lancs. T.: Burnley 3121-2 and 3203. Jigs and tools; components.

Burton, Griffiths and Co., Ltd., Machine Tools Division, Kitts Green, Birmingham, 33. T.: Stechford 3071; and Small Tools Division, Montgomery St., Birmingham, 11. T.: Victoria 2351. Machine and small tools.

Carborundum Co., Ltd., The, Trafford Park, Manchester, 17. T.: Trafford Park 2381. Abrasives, refractories and crucibles.

Carter, B. and F., and Co., Ltd., Albion Works, Bolton. T.: Bolton 4344. Counting instruments.

Chamberlain Industries, Ltd., Staffa Works, Staffa Rd., Leyton, London, E.10. T.: Leytonstone 3678. Tube-bending machines, presses, overhead travelling and mobile cranes.

Chiltern Hunt, Ltd., Hemel Hempstead, Herts. T.: Boxmoor 1091 and King's Langley 3264-5. Polythene Layflat film, gusseted bags and liners.

Churchill, Charles, and Co., Ltd., Coventry Rd., South Yardley, Birmingham. T.: Acocks Green 2281. Machine tools.

Churchill Machine Tool Co., Ltd., The, Broadheath, Manchester. T.: Altrincham 3262. Machine tools.

Cincinnati Milling Machines, Ltd., Woodlands Farm Rd., Farm Rd., Tyburn, Birmingham, 24. T.: Ashfield 1104. Milling, die-sinking, cutter-sharpening, centreless grinding and surface-broach machines.

Consolidated Pneumatic Tool Co., Ltd., 232 Dawes Rd., London, S.W.6. T.: Fulham 7722. Air compressors and portable pneumatic tools.

Constructors, Ltd., Tyburn Rd., Birmingham, 24. Steel storage equipment.

Cornercroft, Ltd., Ace Works, Queen Victoria Rd., Coventry. T.: Coventry 40561. Jigs, press tools, special-process machines, gauges, assembly fixtures.

Coventry Gauge and Tool Co., Ltd., Fletchamstead, Coventry. T.: Coventry 5521. Thread grinders and special machine tools. Gauges, measuring instruments, jigs and fixtures.

Dancer and Herne, Bros., Ltd., Penn St., nr. Amersham, Bucks. Jigs and tools; rubber press tools; Hufford tools; templates.

Darwins, Ltd., Tinsley, Sheffield, 9. T.: Sheffield 41341. Hacksaw blades; permanent magnets, tool bits.

Dowding and Doll, Ltd., 364 Kensington High St., London, W.14. T.: Western 8077. Machine tools; injection-moulding and die-casting machines; thread-milling hobs.

Dunlop and Ranken, Ltd., 147 The Headrow, Leeds, 1. T.: Leeds 27301. Engineers' and contractors' hand-forged tools.

Edwards, F. J., Ltd., 359-361 Euston Rd., London, N.W.1. T.: Euston 4681. Machine tools and presses.

(*Continued on page* 345)

Trade Directory . . . .

(*Continued from page* 344)

Equipment and Engineering Co., Ltd., The, 2-3 Norfolk St., Strand, London, W.C.2. T.: Temple Bar 1088; and 164-170 Mare St., London, E.8 T.: Amherst 6301. Electro-magnetic crack detectors; Magnaflux crack-detecting ink. Degreasing plant.

Fenner, J. H., and Co., Ltd., Marfleet, Hull, Yorks. T.: Hull Central 13900. V-belts.

Ferro Enamels, Ltd., Wombourne, Wolverhampton. T.: Wombourne 2281. Furnaces for high-temperature ceramic coatings on nickel-chrome alloys and sheet iron.

Fielding and Platt, Ltd., Atlas Works, Gloucester. T.: Gloucester 20351. Presses, machines and ancillary equipment.

Firth Brown Tools, Ltd., Speedicut Works, Carlisle St., E. Sheffield, 4. T.: Sheffield 27151. Engineers' cutting tools.

Henderson Safety Tank Co., Ltd., The, Elstree Way, Boreham Wood, Herts. T.: Elstree 1758-9 and 1917. Jigs and tools.

Herbert, Alfred, Ltd., P.O. Box No. 30, Edgwick Works, Coventry. T.: Coventry 88781. Machine tools; small tools; grinding wheels; measuring and inspection equipment.

Holbrook Machine Tool Co., Ltd., 44 Martin St., Stratford, London, E.15. T.: Maryland 2451. Precision lathes.

Hopkins, E. C., Ingleby Works, Grosvenor St. West. Birmingham, 16. Flexible shaft machines.

Incandescent Heat Co., Ltd., Cornwall Rd., Smethwick, Birmingham. T.: Smethwick 2121. Metallurgical furnaces.

Jenks Bros., Ltd., Britool Works, Bushbury, Wolverhampton. T.: Wolverhampton 31281. Britool socket and ring wrenches.

Jones and Attwood, Ltd., Stourbridge. T.: Stourbridge 5106-7-8. Small bench power presses.

King, Geo. W., Ltd., Argyle Works, Stevenage, Herts. T.: Stevenage 440. Gantry cranes, conveyors, hoisting equipment and sliding-door gear, etc.

Lacy-Hulbert and Co., Ltd., Boreas Works, Beddington, Croydon. T.: Croydon 5504. Compressors, vacuum pumps, exhausters, desiccators, spray-painting equipment and pneumatic appliances.

Leytonstone Jig and Tool Co., Ltd., Leytool Works, High Rd., Leyton, London, E.10. T.: Leytonstone 5022. Jigs, fixtures and press tools and equipment.

Loewy Engineering Co., Ltd., The, Wallisdown Rd., Bournemouth, Hants. T.: Winton 5000; and 1 Albemarle St., London, W.1. T.: Hyde Park 9959. Martin Marform metal-forming equipment.

Marbaix, Gaston E., Ltd., Devonshire House, Vicarage Cres., Battersea, London, S.W.11. T.: Battersea 8888. Machine tools.

Marley, W. H., and Co., Ltd., New Southgate Works, 105 High Rd., London, N.11. T.: Enterprise 5234 and 5578. Machine-tool accessories.

Martonair, Ltd., Parkshot, Richmond, Surrey. Pneumatic equipment; air hoists.

Masson Seeley and Co., Ltd., 14 Howick Place, London, S.W.1. T.: Victoria 2151. Masseeley name-plate machines; stamping and marking machines and presses. Aircraft and engine components.

Mek-Elek Engineering, Ltd., 17 Western Rd., Mitcham, Surrey. T.: Mitcham 3072. Industrial lighting units.

Mercury Truck and Tractor Co., Ltd., The Quay, Gloucester. T.: Gloucester 24451-2. Hydraulic test equipment and tripod jacks; power-plant stands.

Metalisation, Ltd., Barclays Bank Chambers, Dudley, Worcs. T.: Dudley 3321. Metal-spraying plant.

Morgan Crucible Co., Ltd., The, Battersea Church Rd., Battersea, London, S.W.11. T.: Battersea 8822. Crucible and crucible furnaces.

Morris, B. O., Ltd., Morrisflex Works, Britton Rd., Stoke, Coventry. T.: Coventry 5081. Morrisflex flexible shaft equipment, polishing lathes, backstand idlers and polishing materials; rotary wire and fibre brushes; special-purpose machines.

Neill, James, and Co. (Sheffield), Ltd., Napier St., Sheffield, 11. T.: Sheffield 26781. Steel eclipse hacksaw blades and frames; engineers' tools, permanent magnets and chucks.

Northey Rotary Compressors, Ltd., 200-202 Alder Rd., Parkstone, Poole, Dorset. T.: Parkstone 4900. Air and oxygen exhausters for high-altitude instrument testing.

Power Flexible Tubing Co., Ltd., The, Derby Works, Finsbury Park, London, N.4. T.: Stamford Hill 6696. Metalflex hose for steam presses; steel ventilating hose; flexible shaft outer casings; cable armouring; bellows-type expansion joints.

Power Jacks, Ltd., Valetta Rd., Acton, London, W.3. T.: Shepherd's Bush 3443. Hydraulic jacks and Newton Hydratruck hydraulic lift trucks.

Randall, James H., and Son, Ltd., Paddington Green Works, London, W.2. T.: Ambassador 1661. Workshop equipment.

Randalrak, Ltd., 106 Victoria St., London, S.W.1. T.: Victoria 3485. Randalrak industrial storage and handling equipment; Planstore storage and filing equipment.

Ransomes, Sims and Jefferies, Ltd., Orwell Works, Ipswich. T.: Ipswich 2201. Electric, fork-lift and tiering trucks.

Robertson, W. H. A., and Co., Ltd., Bedford. Trimming and slitting equipment, etc.

Rossell, Henry, and Co., Ltd., Waverley Works, Effingham Rd., Sheffield. Jigs, fixtures and press tools; engineers' small tools.

Roto-Finish, Ltd., 39 Park St., London, W.1. T.: Grosvenor 6671-5. Barrel-finishing equipment.

Salter, Geo., and Co., Ltd., West Bromwich. T.: West Bromwich 1855. Weighing machines.

Schoen Division—F. W. Berk and Co., Ltd., Brent Cres., North Circular Rd., N.W.10. T.: Elgar 3533. Shot-blasting metal and plastic spraying.

Schrader's Son, A., Division of Scovill Manufacturing Co., 829 Tyburn Rd., Erdington, Birmingham, 24. Tyre valves, parts and pressure gauges.

Scintilla, Ltd., 20 Carlisle Rd., The Hyde, Hendon, London, N.W.9. T.: Colindale 8844. Lesto portable tools, etc.

Scottish Distributors, Ltd., Aeronautical and Scientific Division, 62 Shirland Rd., Maida Vale, London, W.9. T.: Cunningham 8080. Laboratory equipment; fuel-measuring equipment; engineers' hand and machine tools. Engineers Tools Division: High-speed cutters, etc.

Selson Machine Tool Co., Ltd., Cunard Works, Chase Rd., North Acton, London, N.W.10. Machine tools.

Skinners (Southampton), Ltd., Millbrook Trading Estate, Southampton. T.: Southampton 71167-8. Press tools, jigs and fixtures, gauges; prototype machining.

Steels Engineering Products, Ltd., Crown Works, Sunderland. T.: Sunderland 56281. Coles mobile cranes; Electric Eeltractors.

Suffolk Iron Foundry (1920), Ltd., Sifbronze Works, Stowmarket, Suffolk. T.: Stowmarket 183-5. Oxy-acetylene welding rods and fluxes; Sifbronze regulators. Demon welding blowpipes; Catseye welding goggles.

Talbot Tool Co., Ltd., 87 Borough High St., London, S.E.1. T.: Hop 3722 and 3310. Grip drill and reamer jig bushes; Nurogrip and Polygrip jig bushes, etc.

Taylor, Taylor and Hobson, Ltd., Leicester. Profile projectors, electrical comparators; alignment telescopes, etc.

Turner Bros. (Birmingham), Ltd., Galvanic Works, Cliveland St., Birmingham, 19. T.: Aston Cross 1741. Press tools, jigs, fixtures and power presses.

Vactric (Precision Tools), Ltd., 196 Sloane St., London, S.W.1. T.: Sloane 9656. Precision tools, gauges, moulds, etc.

Vaughan, Edgar, and Co., Ltd., Legge St., Birmingham, 4. Oils, compounds and salts.

Wade Engineering, Ltd., Gatwick Airport, Crowhurst Rd., Brighton, 6. T.: Brighton 59277. Roots-type compressors; air motors, rotary variable-compression compressors and decompressors.

Ward, H. W., and Co., Ltd., Dale Rd., Birmingham, 29. Capstan and turret lathes.

Westminster Airways Servicing, Ltd., Priory Rd., Hardway, Gosport, Hants. T.: Gosport 88081-3. Jigs and tools.

Wickman, Ltd., Banner Lane, Tile Hill, Coventry. T.: Coventry 66271. Automatic lathes, tool-grinding machines; Wimet tools; dies, press tools, etc.

Williams and James (Engineers), Ltd., Chequers Bridge, Gloucester. T.: Gloucester 24021-3. Air compressors.

Wolf Electric Tools, Ltd., Pioneer Works, Hanger Lane, Ealing, W.5. T.: Perivale 5631. Portable electric tools.

Young, A. S., and Co., Ltd., Tower Works, Woodside Lane, N. Finchley, London, N.12. T.: Hillside 6606-7. Oxy-acetylene welding equipment, rods and accessories.

5—Controls, Systems and Accessories

A.B.C. Motors, Ltd., Walton-on-Thames, Surrey. T.: Walton-on-Thames 774-5. Auxiliary power units; refuelling units for seaplanes, etc.

Amal, Ltd., Holdford Rd., Witton, Birmingham, 6. T.: Birchfield 4571. Fuel pumps, valves and filters; flame traps and float chambers.

Austinlite, Ltd., Crawley, Sussex. Rotary switches, etc.

Coventry Victor Motor Co., Ltd., Coventry. T.: Coventry 3054-6. Auxiliary powerplant prime movers. Flying Neptune light aero-engine.

Evershed and Vignoles, Ltd., Acton Lane Works, Chiswick, London, W.4. T.: Chiswick 3670. F.H.P. motors, servo amplifiers and flap positioners.

Godden, M. H. (Cheltenham), Ltd., Bouncers Lane, Cheltenham, Glos. T.: Cheltenham 7202-3. De-icing equipment.

Hale, Hamilton and Co., Ltd., Frays Mill Works, Cowley Rd., Uxbridge, Middx. T.: Uxbridge 6525-6. Pressure reducing and solenoid valves; pressure-control equipment.

Harvey Electronics, Ltd., 273 Farnborough Rd., Farnborough, Hants. T.: Farnborough 1120. Servo units, bulk erasers for magnetic tape; specialized electronic and electro-mechanical devices.

Keelavite Rotary Pumps and Motors, Ltd., Allesley, Coventry. T.: Meriden 441. Keelavite hydraulic pumps, motors, cylinders and control gear.

Light Engineering Designs (Gosport), Ltd., Priory Rd., Hardway, Gosport, Hants. T.: Gosport 88081-3. Mechanical and hydraulic design.

R.M.R. Engineering, Brook St., Tring, Herts. T.: Tring 3338. Pipe-line unions and cups.

Scottish Distributors, Ltd., Aeronautical and Scientific Division, 62 Shirland Rd., Maida Vale, London, W.9. T.: Cunningham 8080. Electric motors; air-pressure and vacuum pumps, etc.

Seton Creaghe Engineering Co. (1950), Ltd., Trading Estate, Park Royal Rd., London, N.W.10. T.: Elgar 5257-8. High-precision electro-mechanical devices and mechanisms.

Stemco, Ltd., 740 High Rd., Tottenham, London, N.17. T.: Tottenham 5371. Brodie-Kent meters, strainers, eliminators, flow-control valves, refuellers, etc.

S.U. Carburetter Co., Ltd., The, Wood Lane, Erdington, Birmingham, 24. Piston-engine petrol-injection equipment.

Thermotank, Ltd., 150 Helen St., Glasgow, S.W.1. Air-conditioning plant.

T.K.S. (Aircraft De-icing), Ltd., Drayton House, Gordon St., London, W.C.1. T.: Euston 4650. De-icing systems and fluids.

Varley Pumps and Engineering, Ltd., Ferry Lane, Brentford, Middx. T.: Ealing 1186. Pumping equipment; nitrogen reducing valves.

White, S. S., Co. of Gt. Britain, Ltd., Britannia Works, St. Pancras Way, London, N.W.1. T.: Euston 5393. Torsional flexible remote controls and flexible shaft assemblies for engine speed indicators.

6—Instrument Equipment

Accurate Recording Instrument Co., Aric Works, Garth Rd., Lower Morden, Surrey. T.: Derwent 2211. Mechanical dial-type instruments and contfols.

Aerocontacts, Ltd., Gatwick Airport, Horley, Surrey. T.: Horley 1510. Instruments.

A.J.W. (Instruments), Ltd., Gatwick Airport, Horley, Surrey. T.: Horley 1510 (ext. 38 and 105) and 1420. Aircraft instruments.

Ancillary Developments, Ltd., Blackbushe Airport, nr. Camberley, Surrey. T.: Camberley 1437-8. Aircraft instruments and components, etc.

Appleby and Ireland, Ltd., Kempshott House, nr. Basingstoke. T.: Dummer 216. Vacuum and pressure instruments; diaphragms, capsules and bellows.

Avimo of Taunton, Taunton, Somerset. T.: Taunton 3634-5. A.S.I. pressure heads, cathode-ray recording instruments, oxygen regulators, gyros, etc.

Barnet Instruments, Ltd., Bath Place, Barnet, Herts. T.: Barnet 0066. Pressure, vacuum and compound gauges, and testing equipment.

British Rototherm Co., Ltd., The, Merton Abbey, London, S.W.19. T.: Liberty 7661. Rototherm dial-type bi-metallic and distance-reading temperature gauges, temperature and pressure recorders.

Browne, Henry, and Son, Ltd., Station Works, Barking, Essex. T.: Rippleway 4054-6. Sestrel aero compasses and other instruments.

Carter, B. and F., and Co., Ltd., Bolton, 17, Lancs. Ratchet and revolution counters; speed indicators, measuring units, etc.

Cooke, Troughton and Simms, Ltd., Haxby Rd., York. T.: York 4112. Optical measuring instruments; microscopes.

Counting Instruments, Ltd., 5 Elstree Way, Boreham Wood, Herts. T.: Elstree 1382. Mechanical and electro-magnetic counters, etc.

Dent and Co., and Johnson, Ltd., Linwood, Renfrewshire. T.: Johnstone 109. Dent-Johnson compasses, etc.

Dowty Nucleonics, Ltd., Cheltenham, Glos. T.: Cheltenham 53606. Vibration instruments, revolution indicators, strain and temperature measurement, high-speed counting equipment.

Far East Aviation and Trading Co., Ltd., Orchard House, 14 Great Smith St., London, S.W.1. T.: Abbey 3546-7. Electronic, electro-mechanical and optical instruments; data recording and processing equipment.

Greenwood, P. W. (Willesden), Ltd., 62 Shirland Rd., London, W.9. T.: Cunningham 4422. Blind-flying and navigational instruments.

Trade Directory . . . .

Hilger and Watts, Ltd., 48 Addington Sq., London, S.E.5. T.: Rodney 5441. Scientific instruments and measuring equipment.

K.D.G. Instruments, Ltd., Purley Way, Croydon, Surrey. T.: Thornton Heath 3868. Aircraft instruments.

Kent, George, Ltd., Biscot Rd., Luton, Beds. T.: Luton 2440. Flow meters, etc.

Measuring Instruments (Pullin), Ltd., Electrin Works, Winchester St., Acton, London, W.3. T.: Acorn 4651. Electrical indicating instruments, relays, test and control gear.

Munro, R. W., Ltd., Cline Rd., Bounds Green, London, N.11. T.: Enterprise 4422. Flight-record instruments, indicators and gauges.

Page Engineering Co., Page Works, Forge Lane, Sunbury-on-Thames, Middx. T.: Sunbury-on-Thames 2642. Electrical and mechanical instruments and equipment.

Painton and Co., Ltd., Kingsthorpe, Northampton. T.: Northampton 32354. Electrical components.

Power Flexible Tubing Co., Ltd., The, Derby Works, Vale Rd., Finsbury Park, London, N.4. T.: Stamford Hill 6696. Flexible metallic bellows; temperature-control apparatus.

Reid and Sigrist, Ltd., Braunstone Works, Braunstone, Leicester. T.: Leicester 88101-4. Aeronautical instruments; specialists in gyroscopic instruments and test gear.

Rotameter Manufacturing Co., Ltd., 602 Purley Way, Croydon, Surrey. T.: Croydon 3816-9. Flow meters.

Royston Instruments, Ltd., Hanworth Lane, Chertsey, Surrey. T.: Chertsey 3431-2. Data recording, handling and processing equipment. Midas magnetic tape-recording system.

Scottish Distributors, Ltd., Aeronautical and Scientific Division, 62 Shirland Rd., Maida Vale, London, W.9. T.: Cunningham 8080. Gyro and meteorological instruments, solenoids, simulator equipment.

Stanley, W. F., and Co., Ltd., Avery Hill Rd., New Eltham, London, S.E.9. T.: Eltham 3836. Instruments.

Test Equipment, Ltd., Gatwick Rd., Crawley, Sussex. T.: Crawley 2350. Gyroscopic instruments and research equipment.

Thompson, J., Langham, Ltd., 88 High Rd., Bushey Heath, Herts. T.: Bushey Heath 2411. Pressure transducers, accelerometers, etc.

Williams and James (Engineers), Ltd., Chequers Bridge, Gloucester. T.: Gloucester 24021. Reducing valves and pressure regulators; W. and J. "pneumerstat."

A new feature in the range of mechanical and electro-magnetic counters by Counting Instruments, Ltd., is this in-line digital display unit ($2^5/_8$ in. high, $1^9/_{16}$ in. wide, $5^{13}/_{32}$ in. long). Each unit comprises a system of lenses whereby a figure or letter is projected on to a screen by 12 lamps. Units can be banked together.

Wynstruments, Ltd., Staverton Aerodrome, Gloucester. T.: Churchdown 3264. Accelerometers and flight-test equipment.

7—Radio and Electrical Equipment

Aerocontacts, Ltd., Gatwick Airport, Horley, Surrey. T.: Horley 1510. Electrical and radio equipment.

Aeronautical Radio Services, Ltd., Doman Rd., Camberley, Surrey. T.: Camberley 2341. Aircraft radio and radar.

Air Transport (Charter), (C.I.), Ltd., 7 Willow Rd., Colnbrook, Bucks. T.: Colnbrook 280 and 408. Electronic workshop and field test equipment.

Anticoustic Co., The, 204 High St., Guildford, Surrey. T.: Guildford 66488. Electrical and electronic equipment; ear defenders and sound insulators; acoustic booths and soundproof cabinets.

Automatic Coil Winder and Electrical Equipment Co., Ltd., 92-96 Vauxhall Bridge Rd., London, S.W.1. T.: Victoria 3404. Electrical and electronic test equipment; coil-winding machines.

Autoset (Production), Ltd., Stour St., Birmingham, 18. T.: Edgbaston 1143-4. G.E.C., E.E.C., Metro-Vickers radar equipment.

Bonella, D. H., and Son, Ltd., West Hill, Hoddesdon, Herts. T.: Hoddesdon 2283. Electrical accessories.

British Communications Corpn., Ltd., Exhibition Grounds, Wembley, Middx. T.: Wembley 1212. VHF communications equipment; multi-channel automatic recording system for ATC, flight-deck communications system for aircraft carriers, electronic measuring apparatus.

British Electrical Resistance Co., Ltd., Queensway, Enfield, Middx. T.: Howard 2411. Auto-transformers, resistances, rheostats, potentiometers, etc.

Batiers, Ltd., Atlantic Works, Grange Rd., Small Heath, Birmingham, 10. T.: Victoria 3491-6. Lamps; marker lights.

Cathodeon, Ltd., Church St., Cambridge. T.: Cambridge 56481. Tangible fire-protection and high-voltage high-speed evacuated relay switches.

Crypton Equipment, Ltd., Bridgwater, Somerset. Electrical equipment.

C.W.C. Equipment, Ltd., Acorn Works, Kings Grove, Maidenhead, Berks. T.: Maidenhead 2275. Electrical switches.

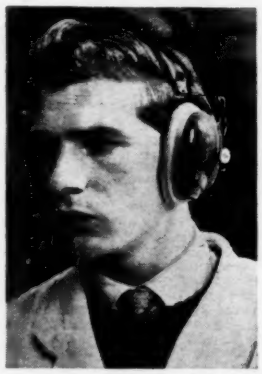
Davis and Timmins (Aircraft), Ltd., 270 High Rd., Ilford, Essex. T.: Ilford 3460. Electrical parts and cabin lamps.

Diamond 'H' Switches, Ltd., Gunnersbury Av., London, W.4. T.: Chiswick 6444. Switches and appliances.

Edison Swan Electric Co., Ltd., 155 Charing Cross Rd., London, W.C.2. T.: Gerrard 8660. Fluorescent and flood-lighting equipment; cables. Ediswan Mazda valves and cathode-ray tubes; electronic equipment, etc.

Electrical and Refrigeration Services, Ltd. (E.R.S. (London) Ltd.), Brookwood Rd., London, S.W.18. Radio connectors, etc.

Racal Engineering, Ltd. (associated with Racal, Ltd.,) has produced this Type RA.17 receiver, which is being adopted as standard equipment by armed Services in many parts of the World.



The Mk. V Nosonic ear defender, featuring sound seal for greater efficiency and comfort, has been produced by the Anticoustic Co.

Electronic Components, Weedon Rd., Industrial Estate, Northampton. T.: Northampton 2467. Faders, attenuators, switches, etc.

Evershed and Vignoles, Ltd., Acton Lane Works, Chiswick, London, W.4. T.: Chiswick 3670. Electrical controls and test sets.

Fairey Marine, Ltd., Hamble, nr. Southampton, Hants. T.: Hamble 2135. Radomes.

Greenwood, P. W. (Willesden), Ltd., 62 Shirland Rd., London, W.9. T.: Cunningham 4422. Electrical components and accessories.

Harvey Electronics, Ltd., 273 Farnborough Rd., Farnborough, Hants. T.: Farnborough 1120. Electric and electronic test equipment.

International Aeradio, Ltd., 40 Park St., London, W.1. T.: Hyde Park 5024. Telecommunications, radio and radar aids.

Land, Air and Sea Instruments Co., Ltd., 328 Grand Buildings, Trafalgar Sq., London, W.C.2. T.: Whitehall 4864. Lascom aircraft radio communication and navigation equipment; VHF radio telephones.

Light Engineering Designs (Gosport), Ltd., Priory Rd., Hardway, Gosport, Hants. T.: Gosport 88081-3. Electronics and electrical design.

Lyon, Arthur, and Co. (Engineers), Ltd., 6 Carlos Place, Grosvenor Sq., London, W.1. T.: Hyde Park 9141. Generator test benches and inverter testers.

Magnetic Devices, Ltd., Exning Rd., Newmarket. T.: Newmarket 3181. Relays.

Masteradio, Ltd., Fitzroy Place, London, N.W.1. T.: Euston 2628. Radio receivers.

M.B. Metals, Ltd., Vale Works, Vale Rd., Portslade, Sussex. T.: Hove 48623. Butting connectors, plugs and sockets; lamps, etc.

Nife Batteries, Redditch, Worcs. T.: Redditch 157. Nife nickel cadmium alkaline accumulators for ground starter batteries, etc.

N.S.F., Ltd., 9 Stratford Place, London, W.1. T.: Langham 9561. N.S.F.-Oak and Cutler hammer switches, etc.

Page Engineering Co., Page Works, Forge Lane, Green St., Sunbury-on-Thames, Middx. T.: Sunbury-on-Thames 2642 and 2304. Switches; moving-coil relays; temperature indicators, etc.

Painton and Co., Ltd., Kingsthorpe, Northampton. T.: Northampton 32354. Attenuators and faders, stud switches, wire-wound potentiometers, midget RF chokes, etc.

Phœnix Telephone and Electric Works, Ltd., The, The Hyde, Hendon, London, N.W.9. T.: Colindale 7243. Emergency lighting units, double-filament warning lights.

Power Controls, Ltd., Exning Rd., Newmarket, Suffolk. T.: Newmarket 3181. Co-axial, sealed miniature and multi-way plugs, etc.

Pye Telecommunications, Ltd., Newmarket Rd., Cambridge. T.: Teversham 3131. Pye ILS Ranger and Reporter mobile radio-telephones; Pye Transhailer electronic megaphone; 60-W HF fixed-station and 1-kW VHF transmitter.

Racal, Ltd., Western Rd., Bracknell, Berks. T.: Bracknell 941. Electronic equipment.

Rist's Wires and Cables, Ltd., Lower Milehouse Lane, Newcastle, Staffs. T.: Newcastle 69212-4. Cable and cable assemblies and looms, etc.

Rival Lamps, Ltd., Hamm Moor Lane, Weybridge, Surrey. T.: Weybridge 3226-7-8. Filament electric lamp bulbs for aircraft and aerodrome lighting.

Santon, Ltd., Somerton Works, Newport, Mon. T.: Newport 71211. Rotary switches, etc.

Scottish Distributors, Ltd., Aeronautical and Scientific Division, 62 Shirland Rd., Maida Vale, London, W.9. T.: Cunningham 8080. General electrical equipment; plugs, switches, etc.

Siemens Edison Swan, Ltd., 155 Charing Cross Rd., London, W.C.2. T.: Gerrard 8660. Electrical cables; lighting equipment.

Simon Equipment, Ltd., 48-50 George St., Portman Sq., London, W.1. T.: Welbeck 2371. Magnetic monitoring equipment, timing injector units, etc.

Technograph Printed Circuits, Ltd., 32 Shaftesbury Avenue, London, W.1. T.: Gerrard 4532. Printed circuits.

(*Continued on page* 347)

Trade Directory . . . .

8 — *Survival Equipment and Flying Clothing*

A.B.C. Motors, Ltd., Walton-on-Thames, Surrey. T.: Walton-on-Thames 774-5. Auxiliary power units: pumping and generating sets; bilging and refuelling units for seaplanes.

Aerocontacts, Ltd., Gatwick Airport, Horley, Surrey. T.: Horley 1510. Flying clothing, life-saving and survival equipment.

Airborne Service Equipment, Ltd., Arterial Rd., Southend-on-Sea, Essex. T.: Eastwood 55265. Parachutes; air/sea rescue packs. R.A.F. web equipment, kitbags, haversacks.

Beaufort (Air-Sea) Equipment, Ltd., Victoria Rubber Works, Newton Heath, Manchester, 10. T.: Failsworth 1166. Air/sea rescue equipment, marine and flying equipment.

Black and Decker, Ltd., Harmondsworth, Middx. T.: West Drayton 2681-9. Air-rescue saws.

British Parachute Co., Ltd., Chapel St., Manchester, 1. T.: Ardwick 2414. Parachutes; general aircraft safety equipment.

Fairey Marine, Ltd., Hamble, nr. Southampton, Hants. T.: Hamble 2135. Folding dinghies.

Flight Equipment and Engineering, Ltd., 163-169 Brompton Rd., London, S.W.3. T.: Kensington 3698. Passenger seats.

Lea Bridge Industries, Ltd. (Aircraft Section), Priory Works, Arterial Rd., Southend-on-Sea. T.: Eastwood 55265. Air/sea rescue equipment, parachutes, Lindholme gear, etc.

Lewis, D., Ltd. (Dept. F.), 124 Gt. Portland St., London, W.1. T.: Museum 4314. Flying suits, goggles and gloves. Oxygen equipment.

Permutit Co., Ltd., The, Permutit House, Gunnersbury Av., London, W.4. T.: Chiswick 6431. Drinking-water filters; de-salting kits.

Rumbold, L. A., and Co., Ltd., Kingsgate Place, Kilburn, London, N.W.6. T.: Maida Vale 7366-7-8. Lifebelts, stretchers and folding invalid-carrying chairs.

Vosper, Ltd., P.O. Box No. 18, Portsmouth, Hants. T.: Cosham 79481. Seaplane and crash rescue tenders; firefloats.

Windak, Ltd., Woodside, Poynton, Cheshire. T.: Poynton 2261. Electrically heated airborne equipment and clothing.

9 — *Miscellaneous Equipment and Services*

Abbey Panel and Sheet Metal Co., Ltd., Old Church Rd., Coventry. T.: Coventry 89461. Prototype and experimental work.

Aerogalley (Proprietors: Aerocontacts (Aircraft Distributors), Ltd.), Gatwick Airport, Surrey. T.: Horley 5511 and Livingstone 8811, ext. 6601. Aircraft catering equipment; British Commonwealth agents for Stiebel Eltron electrical galley equipment.

Aerolex, Ltd., Bridge Rd., Camberley, Surrey. T.: Camberley 1500. Quick-release lashing equipment; stretcher equipment; safety belts, anchorages.

Airborne Service Equipment, Ltd., Arterial Rd., Southend-on-Sea, Essex. T.: Eastwood 55265. R.A.F. banner and drogue targets (radar and non-radar); aircraft furnishings; kapok cushions.

Aircraft Furnishings, Ltd., 41 Lonsdale Rd., London, W.11. T.: Bayswater 6262-6. Aircraft passenger seats.

Airpak, Ltd., 76 Grosvenor St., London, W.1. T.: Mayfair 3467; and Overton Hants. T.: Overton 259. Upholstery and insulation materials; Tropal and Tropaline.

Airwork, Ltd., 35 Piccadilly, London, W.1. T.: Regent 8494. Aircraft servicing, maintenance, etc.

Aviation Traders, Ltd., 21 Wigmore St., London, W.1. T.: Museum 7791; Southend Airport, Essex. T.: Rochford 56491; and Stansted Airport, Essex. T.: Takeley 391. Experimental design and production; airframe and engine repair.

Boosey and Hawkes (Engineers), Ltd., Sonorous Works, Edgware, Middx. T.: Edgware 5581. Tape and wire recorders, etc.

British Industrial Model Services, Ltd., Priory Rd., Hardway, Gosport, Hants. T.: Gosport 88081-3. Aircraft and industrial precision working models.

Bury Felt Manufacturing Co., Ltd., Hudcar Mills, Bury, Lancs. Wool and hair felt; mechanical cloths.

Cameron Cuss and Co., 54-56 New Oxford St., London, W.1. T.: Museum 8968-9 and 4861. Aircraft clocks.

Cox, John F., and Co., Wyles St., Gillingham, Kent. Aircraft cloths.

Detuners, Ltd., 58 Highgate West Hill, London, N.6. T.: Fitzroy 1221. Cullum Detuners for jet test-bed silencing, mufflers, intake splitter systems.

Dobeckmun Britain, Ltd., 48 Charles St., London, W.1. T.: Grosvenor 5406. Lurex non-tarnishing metallic yarn.

Elsan Manufacturing Co., 51 Clapham Rd., London, S.W.9. Toilet units.

Fairey Marine, Ltd., Hamble, nr. Southampton, Hants. T.: Hamble 2135. Target conversions.

Fisons Pest Control, Ltd., Bourn, Cambs. Pest control.

Harper, C. E., Aircraft Co., Ltd., Exeter Airport, Clyst Honiton, Devon. T.: Exeter 67451. Aircraft service and maintenance.

Ilford, Ltd., Ilford, Essex. T.: Ilford 3000. Photographic sensitized materials, equipment and chemicals.

International Aeradio, Ltd., 40 Park St., London, W.1. T.: Hyde Park 5024. Maps and map mountings. Aerad flight guides; route manuals, air-mileage handbooks and self-examining handbooks for pilots and navigators.

Kodak, Ltd., Kodak House, Kingsway, London, W.C.2. T.: Holborn 7841. Photographic equipment.

London Nameplate Manufacturing Co., Ltd., The, Zylo Works, Brighton, Sussex. T.: Brighton 27025. Nameplate manufacturers. Navigational instruments.

Mallock-Armstrong Co., The, Sussex House, 204 High St., Guildford, Surrey. T.: Guildford 66488. Ear defenders.

Mason, E. N., and Sons, Ltd., Arc-light Works, Colchester, Essex. T.: Colchester 5191. Photographic, photo-copying and drawing-office equipment and materials.

Mavitta Drafting Machines, Ltd., Highlands Rd., Shirley, nr. Birmingham. T.: Solihull 2231. Drawing-office equipment.

M.B. Packaging, Ltd., Vale Rd., Portslade, Sussex. Government and export packers. Designers and packers of aircraft equipment.

Middleton Sheet Metal Co., Ltd., Spring Vale Works, Middleton, Manchester. T.: Middleton 2427-8. Navigators' tables and seats.

Parnall (Yate), Ltd., The Aerodrome, Yate, nr. Bristol. T.: Chipping Sodbury 3231. Components, armaments, etc.

Phoenix Aircraft, Ltd., Cranleigh Common, Cranleigh, Surrey. T.: Bramley 2289. Aircraft designers and constructors. Plans, sets of parts and complete Luton L.A.4a Minor ultra-light aircraft. Development of Luton Major two-seater.

Power Jets (Research and Development), Ltd., Farnborough Pl., Farnborough, Hants. T.: Farnborough 1300-2. Management of gas-turbine patents; technical consultants.

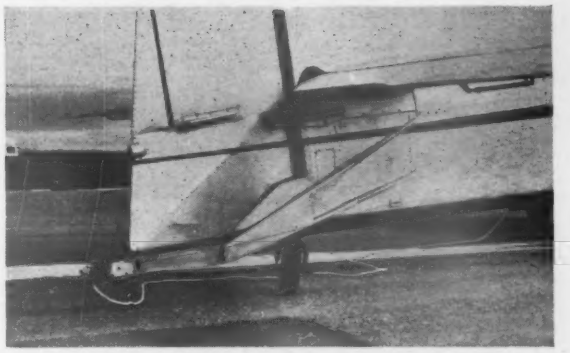
Rumbold, L. A., and Co., Ltd., Kingsgate Pl., Kilburn, London, N.W.6. T.: Maida Vale 7366-7-8. Chairs, multiple seating, bunks, beds, stacking seats, tables, etc., for aircraft; soundproofing, luggage and freight attachments.

Samlesbury Engineering, Ltd., Samlesbury Airfield, nr. Blackburn, Lancs. T.: Blackburn 44668. Drawing-office services; airframe and engine overhaul, servicing and maintenance; aircraft seats; packaging, preservation and dispatch.

Test Equipment, Ltd., Gatwick Rd., Crawley, Sussex. T.: Crawley 2350. Wind-tunnel balances manometers, high- and low-speed models.

Thermotank, Ltd., Helen St., Glasgow, S.W.1. T.: Govan 2444. Plastic and metal punkah louvres.

Transport Seating, Ltd., Western Works, Bromley Street, Birmingham, 9. T.: Victoria 1477 and 1326. Aircraft seats.



Aviation Traders, Ltd., is a company with widely ranging activities in the industry. This picture is of a steel-tube banner-towing yoke extended from the tail of a Prentice, allowing snatch pick-ups.

Seats for a Hunting-Clan Viscount are upholstered in Lurex, a non-tarnishing metallic yarn by Dobeckmun Britain, Ltd., a division of the Dow Chemical Co.

10 — *Airport Construction and Equipment*

Aerocontacts (Ground Equipment), Ltd., Gatwick Airport, Horley, Surrey. T.: Horley 1510. Airport ground-handling equipment; air-conditioning equipment; wheel chocks, stands and jacks.

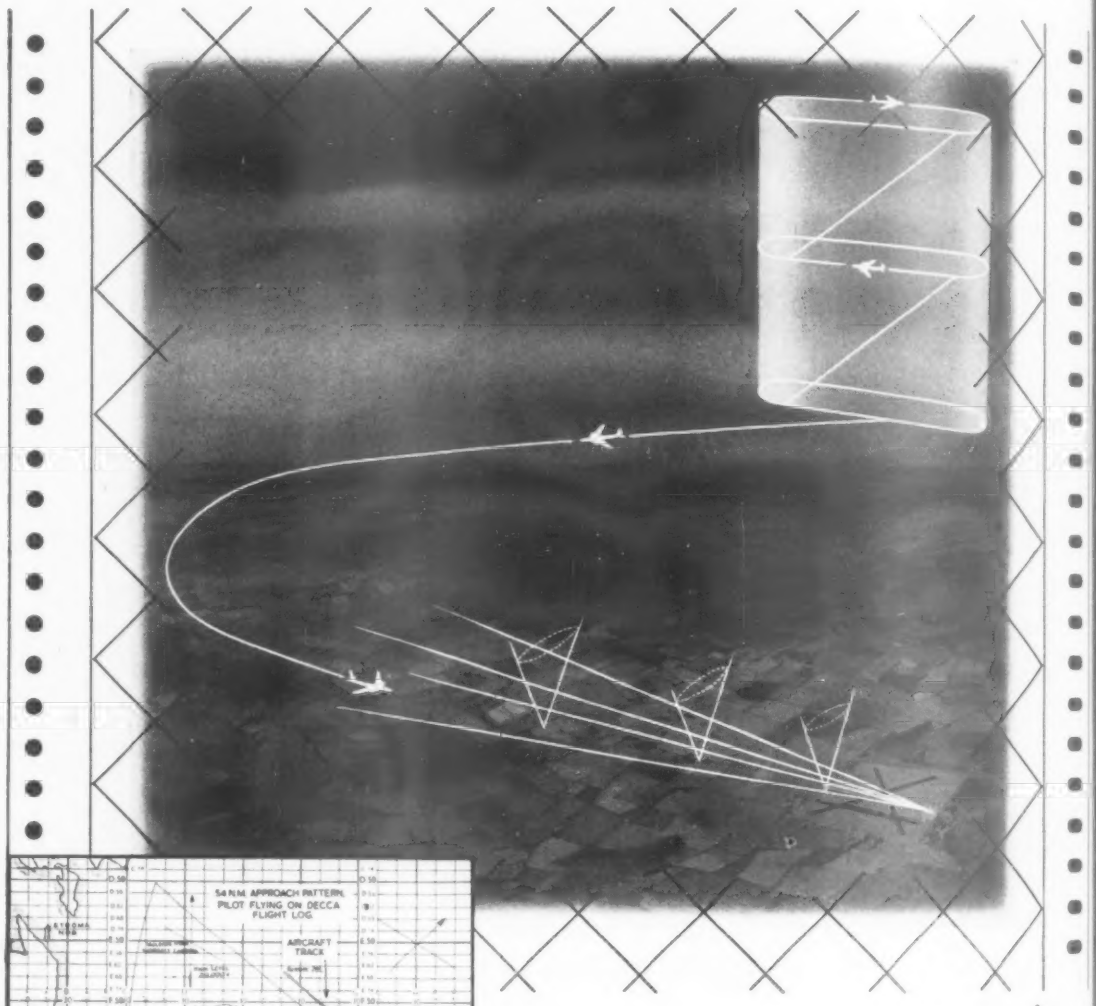
Airborne Service Equipment, Ltd., Arterial Rd., Southend-on-Sea, Essex. T.: Eastwood 55265. Aircraft weatherproof covers; portable hangars.

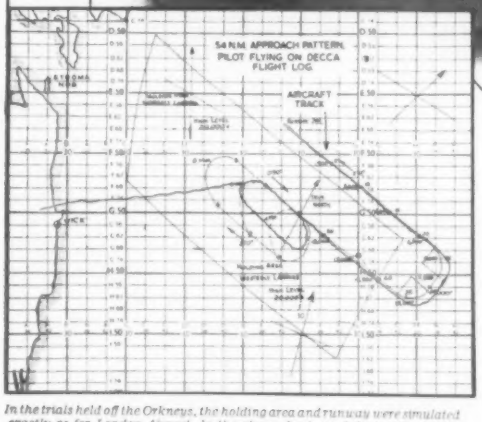
Airfoam Fire Protection, Ltd., 166 Victoria St., London, S.W.1. T.: Victoria 3121. Crash tenders, foam pumps, etc.

Angus, George, and Co., Ltd., Angus House, Newcastle upon Tyne. T.: Newcastle upon Tyne 22656-9. Fire-fighting equipment and protective clothing.

Austinlite, Ltd., Crawley, Sussex. Automatic stand-by generating sets; radar installations.

Aviation Traders, Ltd., 21 Wigmore St., London, W.1. T.: Museum 7791; Southend Airport, Essex. T.: Rochford 56491; and Stansted Airport,





In the trials held off the Orkneys, the holding area and runway were simulated exactly as for London Airport. In the above chart, used during the trials, the holding area with 4, 6 and 8 minute orbits is clearly shown together with the required track to the runway also clearly marked with altitude checks down to the threshold. With the Flight Log the pilot was able to navigate precisely at every stage of the flight, greatly simplifying the entire holding and approach procedure.

THE DECCA NAVIGATOR

THE WORLD'S MOST ACCURATE NAVIGATION SYSTEM

THE DECCA NAVIGATOR COMPANY LIMITED, LONDON, ENGLAND

Decca in the Jet Age

Recent air traffic control trials carried out by the Ministry of Transport and Civil Aviation in a D.H. Comet have proved that, with the Decca Navigator Flight Log, jet aircraft can be navigated accurately regardless of altitude or weather conditions.

No other aid is either suitable or accurate enough for holding at altitude within a defined area. With Decca, such areas can be designated independently of ground facilities and flown exactly, regardless of drift. Exhaustive tests showed that, with the Flight Log, pilots were able to leave a holding area with a very high degree of precision, track can be maintained precisely during the descent from the holding area to touch down, giving the pilot a continuous check of altitude against distance from touch down.

Knowing exactly where he is at all times by reference to his pictorial display, the pilot has an independent check on radar control, and being able to navigate himself accurately in the terminal area his R/T communication with the ground is greatly reduced. The safety of all aircraft is increased by the consequent lightening of the load on the Radar controller. Improved accuracy in time and position keeping, results in the reduction of delays enabling the maximum landing rate to be achieved.

Trade Directory . . . .

8 — *Survival Equipment and Flying Clothing*

A.B.C. Motors, Ltd., Walton-on-Thames, Surrey. T.: Walton-on-Thames 774-5. Auxiliary power units; pumping and generating sets; bilging and refuelling units for seaplanes.

Aerocontacts, Ltd., Gatwick Airport, Horley, Surrey. T.: Horley 1510. Flying clothing, life-saving and survival equipment.

Airborne Service Equipment, Ltd., Arterial Rd., Southend-on-Sea, Essex. T.: Eastwood 55265. Parachutes; air-sea rescue packs. R.A.F. web equipment, kitbags, haversacks.

Beaufort (Air-Sea) Equipment, Ltd., Victoria Rubber Works, Newton Heath, Manchester, 10. T.: Failsworth 1166. Air-sea rescue equipment, marine and flying equipment.

Black and Decker, Ltd., Harmondsworth, Middx. T.: West Drayton 2041-9. Air-rescue saws.

British Parachute Co., Ltd., Chapel St., Manchester, 1. T.: Ardwick 2414. Parachutes; general aircraft safety equipment.

Fairey Marine, Ltd., Hamble, nr. Southampton, Hants. T.: Hamble 2135. Folding dinghies.

Flight Equipment and Engineering, Ltd., 163-169 Brompton Rd., London, S.W.3. T.: Kensington 3698. Passenger seats.

Lea Bridge Industries, Ltd. (Aircraft Section), Priory Works, Arterial Rd., Southend-on-Sea. T.: Eastwood 55265. Air/sea rescue equipment, parachutes, Lindholme gear, etc.

Lewis, D., Ltd. (Dept. F.), 124 Gt. Portland St., London, W.1. T.: Museum 4314. Flying suits, goggles and gloves. Oxygen equipment.

Permutit Co., Ltd., The, Permutit House, Gunnersbury Av., London, W.4. T.: Chiswick 6431. Drinking-water filters; de-salting kits.

Rumbold, L. A., and Co., Ltd., Kingsgate Place, Kilburn, London, N.W.6. T.: Maida Vale 7366-7-8. Lifebelts, stretchers and folding invalid-carrying chairs.

Vosper, Ltd., P.O. Box No. 18, Portsmouth, Hants. T.: Cosham 79481. Seaplane and crash rescue tenders; fireboats.

Windak, Ltd., Woodside, Poynton, Cheshire. T.: Poynton 2261. Electrically heated airborne equipment and clothing.

9 — *Miscellaneous Equipment and Services*

Abbey Panel and Sheet Metal Co., Ltd., Old Church Rd., Coventry. T.: Coventry 89461. Prototype and experimental work.

Aerogalley (Proprietors: Aerocontacts (Aircraft Distributors), Ltd.), Gatwick Airport, Surrey. T.: Horley 5511 and Livingstone 8811, ext. 6601. Aircraft catering equipment; British Commonwealth agents for Stiebel Eltron electrical galley equipment.

Aerolex, Ltd., Bridge Rd., Camberley, Surrey. T.: Camberley 1500. Quick-release lashing equipment; stretcher equipment; safety belts, anchorages.

Airborne Service Equipment, Ltd., Arterial Rd., Southend-on-Sea, Essex. T.: Eastwood 55265. R.A.F. banner and drogue targets (radar and non-radar); aircraft furnishings; kapok cushions.

Aircraft Furnishings, Ltd., 41 Lonsdale Rd., London, W.11. T.: Bayswater 6262-6. Aircraft passenger seats.

Airpak, Ltd., 76 Grosvenor St., London, W.1. T.: Mayfair 3467; and Overton Hants. T.: Overton 259. Upholstery and insulation materials; Tropal and Tropaline.

Airwork, Ltd., 35 Piccadilly, London, W.1. T.: Regent 8494. Aircraft servicing, maintenance, etc.

Aviation Traders, Ltd., 21 Wigmore St., London, W.1. T.: Museum 7791; Southend Airport, Essex. T.: Rochford 56491; and Stansted Airport, Essex. T.: Takeley 391. Experimental design and production, airframe and engine repair.

Boosey and Hawkes (Engineers), Ltd., Sonorous Works, Edgware, Middx. T.: Edgware 5581. Tape and wire recorders, etc.

British Industrial Model Services, Ltd., Priory Rd., Hardway, Gosport, Hants. T.: Gosport 88081-3. Aircraft and industrial precision working models.

Bury Felt Manufacturing Co., Ltd., Hudcar Mills, Bury Lancs. Wool and hair felt; mechanical cloths.

Camerer Cuss and Co., 54-56 New Oxford St., London, W.1. T.: Museum 8968-9 and 4861. Aircraft clocks.

Cox, John F., and Co., Wyles St., Gillingham, Kent. Aircraft cloths.

Detuners, Ltd., 58 Highgate West Hill, London, N.6. T.: Fitzroy 1221. Cullum Detuners for jet test-bed silencing, mufflers, intake splitter systems.

Dobeckmun Britain, Ltd., 48 Charles St., London, W.1. T.: Grosvenor 5406. Lurex non-tarnishing metallic yarn.

Elsan Manufacturing Co., 51 Clapham Rd., London, S.W.9. Toilet units.

Fairey Marine, Ltd., Hamble, nr. Southampton, Hants. T.: Hamble 2135. Target conversions.

Fisons Pest Control, Ltd., Bourn, Cambs. Pest control.

Harper, C. E., Aircraft Co., Ltd., Exeter Airport, Clyst Honiton, Devon. T.: Exeter 67451. Aircraft service and maintenance.

Ilford, Ltd., Ilford, Essex. T.: Ilford 3000. Photographic sensitized materials, equipment and chemicals.

International Aeradio, Ltd., 40 Park St., London, W.1. T.: Hyde Park 5024. Maps and map mountings. Aerad flight guides, route manuals, air-mileage handbooks and self-examining handbooks for pilots and navigators.

Kodak, Ltd., Kodak House, Kingsway, London, W.C.2. T.: Holborn 7841. Photographic equipment.

London Nameplate Manufacturing Co., Ltd., The, Zylo Works, Brighton, Sussex. T.: Brighton 27025. Nameplate manufacturers. Navigational instruments.

Mallock-Armstrong Co., The, Sussex House, 204 High St., Guildford, Surrey. T.: Guildford 66488. Ear defenders.

Mason, E. N., and Sons, Ltd., Arc-light Works, Colchester, Essex. T.: Colchester 5191. Photographic, photo-copying and drawing-office equipment and materials.

Mavitta Drafting Machines, Ltd., Highlands Rd., Shirley, nr. Birmingham. T.: Solihull 2231. Drawing-office equipment.

M.B. Packaging, Ltd., Vale Rd., Portslade, Sussex. Government and export packers. Designers and packers of aircraft equipment.

Middleton Sheet Metal Co., Ltd., Spring Vale Works, Middleton, Manchester. T.: Middleton 2427-8. Navigators' tables and seats.

Parnall (Yate), Ltd., The Aerodrome, Yate, nr. Bristol. T.: Chipping Sodbury 3231. Components, armaments, etc.

Phoenix Aircraft, Ltd., Cranleigh Common, Cranleigh, Surrey. T.: Bramley 2289. Aircraft designers and constructors. Plans, sets of parts and complete Luton L.A.4a Minor ultra-light aircraft. Development of Luton Major two-seater.

Power Jets (Research and Development), Ltd., Farnborough Pl., Farnborough, Hants. T.: Farnborough 1300-2. Management of gas-turbine patents; technical consultants.

Rumbold, L. A., and Co., Ltd., Kingsgate Pl., Kilburn, London, N.W.6. T.: Maida Vale 7366-7-8. Chairs, multiple seating, bunks, beds, stacking seats, tables, etc., for aircraft; soundproofing, luggage and freight attachments.

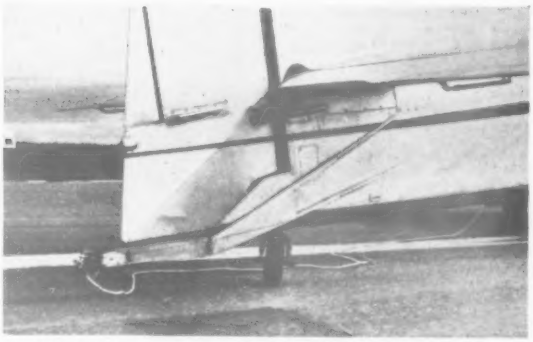
Samlesbury Engineering, Ltd., Samlesbury Airfield, nr. Blackburn, Lancs. T.: Blackburn 44668. Drawing-office services; airframe and engine overhaul, servicing and maintenance; aircraft seats; packaging, preservation and dispatch.

Test Equipment, Ltd., Gatwick Rd., Crawley, Sussex. T.: Crawley 2350. Wind-tunnel balances manometers, high- and low-speed models.

Thermotank, Ltd., Helen St., Glasgow, S.W.1. T.: Govan 2444. Plastic and metal punkah louvres.

Transport Seating, Ltd., Western Works, Bromley Street, Birmingham, 9. T.: Victoria 1477 and 1326. Aircraft seats.

Seats for a Hunting Clan Viscount are upholstered in Lurex, a non-tarnishing metallic yarn by Dobeckmun Britain, Ltd., a division of the Dow Chemical Co.



Aviation Traders, Ltd., is a company with widely ranging activities in the industry. This picture is of a steel-tube banner-towing yoke extended from the tail of a Prentice, allowing snatch pick-ups.

10 — *Airport Construction and Equipment*

Aerocontacts (Ground Equipment), Ltd., Gatwick Airport, Horley, Surrey. T.: Horley 1510. Airport ground-handling equipment; air-conditioning equipment; wheel chocks, stands and jacks.

Airborne Service Equipment, Ltd., Arterial Rd., Southend-on-Sea, Essex. T.: Eastwood 55265. Aircraft weatherproof covers; portable hangars.

Airfoam Fire Protection, Ltd., 166 Victoria St., London, S.W.1. T.: Victoria 3121. Crash tenders, foam pumps, etc.

Angus, George, and Co., Ltd., Angus House, Newcastle upon Tyne. T.: Newcastle upon Tyne 22656-9. Fire-fighting equipment and protective clothing.

Austinlite, Ltd., Crawley, Sussex. Automatic stand-by generating sets; radar installations.

Aviation Traders, Ltd., 21 Wigmore St., London, W.1. T.: Museum 7791; Southend Airport, Essex. T.: Rochford 56491; and Stansted Airport,

Trade Directory . . . .

Essex. T.: Takeley 391. Hangarage; airport freight-handling equipment; trucks, etc.

Bellman Hangars, Ltd., Terminal House, Grosvenor Gardens, London, S.W.1. T.: Sloane 5259. Hangars, large-span buildings and unit construction. Erection, repair and maintenance.

Bolton Gate Co., Ltd., Waterloo St., Bolton, Lancs. T.: Bolton 4240. Bolton top-hung power-operated doors; shutter doors and collapsible gates.

Ceag, Ltd., Queens Rd., Barnsley, Yorks. T.: Barnsley 2208. Lumax and Ceag lamps.

Central Rediffusion Services, Ltd., Lower Regent St., London, S.W.1. T.: Whitehall 0221 and 8202. Public-address systems and Rediffusion wired broadcasting service for airports.

Chance Brothers, Ltd., Lighthouse Works, Smethwick, 40, Birmingham. T.: West Bromwich 1824. Beacons; emergency generating plant, etc.

Conveyancer Fork Trucks, Ltd., Liverpool Rd., Warrington, Lancs. T.: Warrington 2244. Fork-lift trucks and load-handling equipment.

Coseley Engineering Co., Ltd., Dock Meadow Drive, Lanesfield, Wolverhampton. T.: Bilston 41927-9. Prefabricated hangars, etc.

Costain, Richard, Ltd., 111 Westminster Bridge Road, London, S.E.1. T.: Waterloo 4977. Building and civil-engineering contractors.

Coventry Climax Engines, Ltd., Widdrington Rd., Coventry. T.: Coventry 5051. Fork-lift trucks and trailer fire pumps.

Douglas Equipment, Ltd., Kingsditch Lane, Tewkesbury Rd., Cheltenham, Glos. T.: Cheltenham 56361-2-3. Tugmaster aircraft-towing tractors.

Dutton, H. W., and Co., Ltd., 25 Victoria St., London, S.W.1. T.: Abbey 1822. Heating and ventilation.

Esavian, Ltd., Esavian Works, Stevenage, Herts. T.: Stevenage 500. Sliding and folding aluminium doors.

Fire Armour, Ltd., 9 George St., London, W.1. T.: Welbeck 3313. Crash tenders, fire-fighting and rescue vehicles; pumps and ancillary gear. Fognozl equipment.

Hawksley, S. M. D., Ltd., Buckingham Ave., Slough, Bucks. T.: Slough 23212. Aluminium hangars nose docks, etc.

Head Wrightson Aluminium, Ltd., Teesdale Iron Works, Thornaby-on-Tees, Yorks. Light-alloy hangars and aircraft-handling equipment.

Heston Aircraft and Associated Engineers, Ltd., Heston Airport, Hounslow, Middx. T.: Hayes 38441. Passenger steps.

I.T.D., Ltd., 95-99 Ladbroke Grove, London, W.11. T.: Park 8070. Stacatruc and Aerolift fork-lift trucks and Electricar platform trucks; Portapal pallet transporters, etc.

Laing, John, and Sons, Ltd., Bunns Lane, London, N.W.7. T.: Mill Hill 3636. Runways.

Lansing Bagnall, Ltd., Kingsclere Rd., Basingstoke, Hants. T.: Basingstoke 1010. Fork-lift and industrial trucks, etc.

Lincoln Electric Co., Ltd., Welwyn Garden City, Herts. T.: Welwyn Garden City 920. Ground starting units.

Londex, Ltd., Anerley Works, 207 Anerley Rd., London, S.E.20. T.: Sydenham 6258. Aerodrome signalling equipment, lighting, beacons, etc.

Macks Structures (London), Ltd., Bank Buildings, Walham Green, London, S.W.6. T.: Fulham 7233. Bellman and blister hangars, Nissen huts and sectional timber buildings.

Mercury Truck and Tractor Co., Ltd., The Quay, Gloucester. T.: Gloucester 24451-2. Tractors; trucks; maintenance docks; bowsers, steps, stands, jacks, slings, trolleys, etc.

New Welbeck, Ltd., 120 New Bedford Rd., Luton, Beds. T.: Luton 3985. Vacuum cleaners, blowers and sprayers.

Petbow, Ltd., Sandwich, Kent. T.: Sandwich 3311. Aircraft ground-servicing power plant; automatic stand-by generating plant; radio and radar equipment.

Ransomes Sims and Jefferies, Ltd., Orwell Works, Ipswich. T.: Ipswich 2201. Aerodrome preparation and maintenance machinery.

Red Devon, Ltd., Seymour Wharf, Totnes, S. Devon. T.: Totnes 3282. Aircraft starting units, static and mobile greasing sets.

Rotorports, Ltd., Kent House, 87 Regent Street, London, W.1. T.: Regent 3524. Developers of helicopter services and city-centre landing sites in U.K. Advisers on heliport design and operation.

Samlesbury Engineering, Ltd., Samlesbury Airfield, nr. Blackburn, Lancs. T.: Blackburn 44668. Hangarage; assembly and maintenance platforms and stagings, etc.

Short and Mason, Ltd., Aneroid Works, 280 Wood St., Walthamstow, London, E.17. T.: Coppermill 2203-4. Wind-speed and direction indicators; special aneroid barometers for control towers.

Siemens Edison Swan, Ltd., 155 Charing Cross Rd., London, W.C.2. T.: Gerrard 8660. Airfield lighting equipment.

Smiths of Stockport, Ltd., 205-207 Wellington Rd. South, Stockport. T.: Stockport 4642. Airborne and ground equipment.

Spurling Motor Bodies, Ltd., Edgware Rd., The Hyde, London, N.W.9. T.: Colindale 7171. Aircraft stairways.

Steel Barrel Co., Ltd., The, Phœnix Works, Uxbridge, Middx. T.: Uxbridge 8535-8. Tankmakers; pressure-test units; airport dispenser units for oil, methanol, etc.; mobile fuellers; tank trailers and Pluto fuellers.

Stone-Chance, Ltd., Crawley, Sussex. T.: Crawley 25251. Aerodrome lighting equipment.

Tannoy, Ltd., 348 Norwood Rd., West Norwood, London, S.E.27. T.: Gipsy Hill 1131. Tannoy equipment and systems.

A Mercury Model 10F tractor is seen here hauling baggage trailers at London Airport. Fifty of this type have been supplied to Trans World Airlines by the manufacturers, the Mercury Truck and Tractor Co., Ltd.

Conveyancer Fork Trucks, Ltd., supplies freight-handling vehicles for operation at airports throughout the World. Here one is being used to load the forward freight compartment of an Aer Lingus Dakota.

Vosper, Ltd., P.O. Box 18, Portsmouth, Hants. T.: Cosham 79481. Refuelling launches.

Westland Engineers, Ltd., Yeovil, Somerset. Specialized doors and actuating gear.

Williams and James (Engineers), Ltd., Chequers Bridge, Gloucester. T.: Gloucester 24021. Air and oil-free compressors; two-stage compressors and three-stage sets for aircraft ground servicing.

Wimpey, George, and Co., Ltd., Hammersmith Grove, London, W.6. T.: Riverside 2000. Airfield construction.

Y.S.C., Ltd., The, 45-47 Copeland Rd., London, S.E.15. T.: New Cross 6113. Very cartridges, Holt flares, etc.

11 — *Fuels and Oils*

Acheson Colloids, Ltd., 18 Pall Mall, London, S.W.1. T.: Whitehall 2034-9. Dispersions of "dag" colloidal graphite and colloidal molybdenum disulphide.

British Oxygen Co., Ltd., The, Bridgewater House, Cleveland Row, London, S.W.1. T.: Whitehall 9777. Liquid-oxygen rocket-fuel oxidant.

Gulf Oil (Great Britain), 6-7 Grosvenor Pl., London, S.W.1. T.: Belgravia 5011. Lubricants and cutting oils.

Laporte Chemicals, Ltd., Luton, Beds. T.: Luton 4390. H.T.P. chemical fuels; Peroxy compounds (organic).

Mobil Oil Co., Ltd., Caxton House, Westminster, London, S.W.1. T.: Whitehall 1010. Mobilgas and Mobil Diesel; Mobiloil Aero engine oils, fluids and specialities; Mobilgreases and Mobil industrial lubricants.

Ragosine Oil Co., Ltd. (Inc. Rocol, Ltd.), Minerva Works, Woodlesford, nr. Leeds. T.: Rothwell 2184. Lubricants and extreme viscosity compounds.

Regent Oil Co., Ltd., 117 Park St., London, W.1. T.: Mayfair 8474. Regent and Caltex products.

Sternol, Ltd., Royal London House, Finsbury Sq., London, E.C.2. T.: Monarch 3871. Soluble, straight-cutting, quenching and rust-preventive oils.

Vacuum Oil Co., Ltd., Caxton House, Westminster, London, S.W.1. T.: Whitehall 1010. Mobiloil Aero aero-engine oils, fluids and specialties; Mobilgreases.

Vaughan, Edgar, and Co., Ltd., Legge St., Birmingham, 4. Oils and compounds for metal working, heat-treatment oils and salts.

Wakefield, C. C., and Co., Ltd., 46 Grosvenor St., London, W.1. T.: Mayfair 9232. Aero lubricants; Castrol and Castrolaero oils and greases.

12 — *Paints, Cleaners and Finishing Processes*

Acora Anodising Co., Ltd., Durham Rd., Boreham Wood, Herts. T.: Elstree 3116. Aluminium finishes.

Aerocontacts, Ltd., Gatwick Airport, Horley, Surrey. T.: Horley 1510. Metal polishing and finishing; paints and varnishes.

Alumilite and Alzak, Ltd., Station Rd., Merton Abbey, London, S.W.19. T.: Liberty 7641. Anodizing, electro-brightening, chemical brightening, etc.

Bennett (Hyde), Ltd., Boston Mills, Hyde, Cheshire. T.: Hyde 1377-9. Gunk D.P. solution and H.S. hydro-seal decarbonizing compound; degreasants.

Berk, F. W., and Co., Ltd., Brent Crescent, North Circular Rd., London, N.W.10. T.: Elgar 3533. Abrasives; building-up equipment; metal spraying and equipment, etc. Schori process.

Fletcher Miller, Ltd., Alma Mills, Hyde, Cheshire. Flick easing oil; Rodol rust preventives; Solvex degreasing compound.

Goddard, J., and Sons, Ltd., Nelson St., Leicester. T.: Leicester 60658 and 23372. Plastic and aluminium polish; lapping media.

Northey Rotary Compressors, Ltd., 200-202 Alder Rd., Parkstone, Poole, Dorset. T.: Parkstone 4900. Oil-free compressors for electro-plating, metal finishing, polishing and spray-painting plants.

Paint Removers, Ltd., York House, Queens Sq., London, W.C.1. T.: Chancery 6877. Paint removers.

Parkes, L. B., and Co., Ltd., 16 Station St., Walsall. T.: Walsall 4546. Anodizing, cadmium plating, Parkerizing and general metal finishing.

Rozalex, Ltd., 10 Norfolk St., Manchester, 2. T.: Blackfriars 1122. Rozalex anti-dermatitis barrier creams and dispensers.

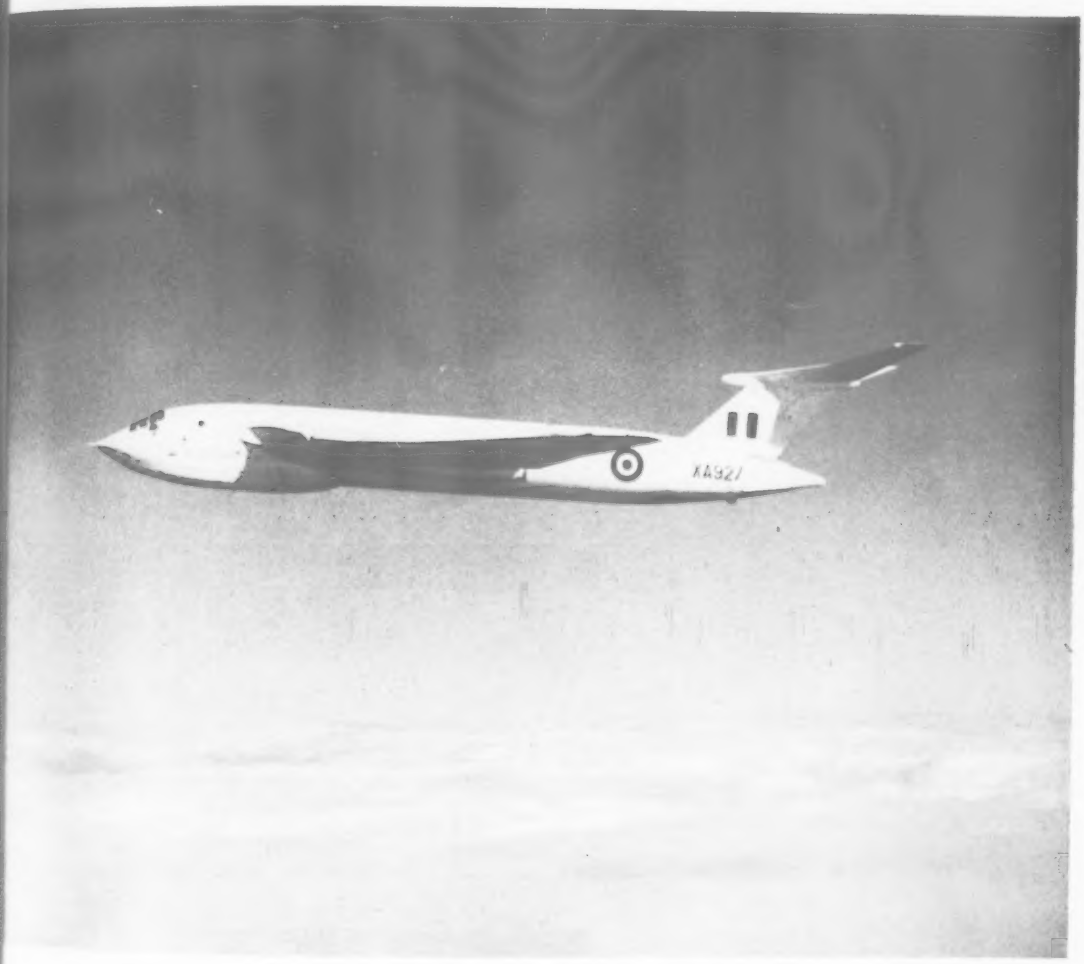
Sternol, Ltd., Royal London House, Finsbury Square, London, E.C.2. T.: Monarch 3871. Barrier creams and hand cleansers.

Union Oxide and Chemical Co., Ltd., Dorster House, 37 Mincing Lane, E.C.3. T.: Mansion House 8021. Chromic acid.

Walterisation Co., Ltd., Waddon Marsh Way, Purley Way, Croydon, Surrey. T.: Croydon 2791. Metal-finishing processes; phosphate paints, bonderite and rust-proofing treatments. Rust removers and solvents. Alkaline-chromatic oxidation process.

Young, A. S., and Co., Ltd., Tower Works, Woodside Lane, N. Finchley, London, N.12. T.: Hillside 6606. Hard-surfacing process for landing skids, arrester gear, etc.

VICTOR



Another Victor, painted a distinctive anti-flash white, enters service. This crescent-winged V-bomber is being flown by its Royal Air Force crew.

IN SQUADRON SERVICE WITH THE R.A.F.

HANDLEY PAGE

RADLETT · LONDON · READING

Begin at the beginning

You've a lot to see in the exhibition, but make sure you don't miss stands 1, 2, 3 and 4. This is where the Smiths Aviation Group of Companies are as usual displaying the widest range of flight, navigation and engine instruments in the show. See the new developments in aircraft instruments and control equipment which makes Smiths' exhibition a first-class show on its own !

STRAIGHT IN
at the main entrance
TURN LEFT . . . and there we are

STAND Nos. 1, 2, 3 & 4

WINGS DAY SEPT. 20th
GIVE FOR THOSE WHO GAVE

SMITHS AVIATION DIVISION

SALES AND SERVICE, CRICKLEWOOD, LONDON, N.W.2

Private Flying

H.J.C.'s CLUB COMMENTARY

● CHAIRMAN of the **Oxford Aeroplane Club**, Mr. Peter Clifford, has sent us some details about the club's "At Home" to be held at Kidlington on Sunday next, August 31.

The party will begin with a Lunch Patrol between 12.00 and 12.30 hrs. B.S.T., and attacking aircraft are to go in between 1,200 and 2,000 ft. above aerodrome level (265 ft. A.M.S.L.). If cloud base is down to 1,000 ft. the patrol will be cancelled.

There will be a time of arrival competition, the winner of which will receive a tankard.

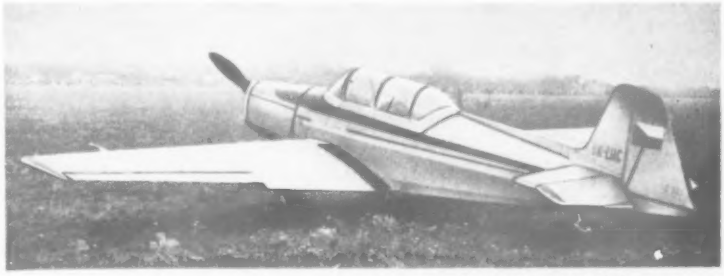
Tower and VDF frequencies, by the way, are 119.7 Mc/s.

After lunch, from 14.30 to 17.00 hrs. will be a flying display which is to include a sailplane demonstration, individual aerobatics and a Tiger Club show. Among visiting aircraft will be an Italian Aviamilano Falco F.8 two-seater.

● OUR Far East correspondent, Mr. A. R. Cole, reports that there has been increased activity in private flying, besides in commercial aviation, in Sarawak, Borneo, according to the colony's annual report for last year.

Sarawak Oilfields, Ltd., at Miri, frequently use aircraft of its parent company, the Brunei Shell Petroleum Co., of Seria, which operates three Princes and three Sealands besides flying two Westland Whirlwinds and two Bell helicopters on charter from Bahamas Helicopters, Ltd. These aircraft were used mostly for executive flying, aerial survey and the supply and transportation of drilling crews and materials to locations.

The Borneo Evangelical Mission, based at Lawas, has maintained communication with missionaries in the interior, carrying supplies, medicine and members of the staff in two Austers. The pilots themselves were missionaries.



Photograph copyright "The Aeroplane"

NEW CZECH.—The latest of the Zlin Trener series is the Type 326 Trener Master, which has a retractable undercarriage. This picture was taken at Bratislava during the recent parachuting championships.

● WE understand that the **Tees-Side Flying Club**, which operated from Greatham aerodrome, West Hartlepool, has closed down. The Tiger Moth has been disposed of and the aerodrome sold. The chairman, Mr. James Lewtas, states that efforts to find alternative accommodation were unsuccessful.

Dr. A. E. Slater's concluding report on

NATIONAL GLIDING WEEK

(The first part of this report was published in our issue of August 15. Some pictures taken at Dunstable appear overleaf.)

AT NYMPSFIELD, the Bristol Gliding Club's site, there were three good long-distance days.

On July 30 there was a race to Baginton, the Coventry Club's home, 56 miles to the N.E., with a good following wind of 25 m.p.h. from W.S.W. All but one got away this time, but only three reached Baginton. A. H. Baynes, in a Skylark 2 from Camphill, won the race at 43.6 m.p.h.; George Burton of Lasham averaged 37 m.p.h. in an Olympia, and Mike Garrod, in the London Club's Sky, 32.8 m.p.h.

The Cambridge Skylark was unfortunately put out of action for the rest of the meeting by a heavy landing at Nympsfield. It had a new electric variometer designed by a club member on the thermistor principle, rather like the Cook instrument which the British team used in Poland.

Thursday's task was "distance along a line through Great Yarmouth," with a light following wind. Two got there—Williamson and Burton. The distance is 182 miles, but the latter started by working four miles upwind and being officially observed, so he just made Gold "C" distance, 300 km., "Chuck" Bentson, of U.S.A. and the London Gliding Club, reached R.A.F. Honington, where he was most hospitably received. The R.A.F. had got used to gliders by this time, but were a bit fussed when John Hands landed there from Dunstable two days before.

A goal race to Cosford, 63 miles to the north, across a moderate west wind, was completed on August 1 only by Scott, who had the first launch of the day, climbed to 13,000 ft. in a cloud over Nympsfield, and glided all the rest of the way except for using one thermal to help him in to Cosford at the end. Several others had Cosford in sight when they came down, but missed that final bit of luck.

On Nympsfield's last good day, August 2, the line through Gt. Yarmouth was set again. This time only Nicholas Goodhart got there, doing the journey in just 3 hr. and breaking the U.K. record for speed over a 200-km. straight line; another few miles, and it would have been the 300-km. record.

No one else got more than half-way, but there were two good climbs in cumulus masses—to 17,000 ft. by Flt. Lt. Morgan and 16,000 ft. by Scott.

* * *

THE SCOTTISH GLIDING UNION at Portmoak, near Kinloss, managed the Scottish region of the contests.

During my stay there was a good deal of cloud, distributed irregularly all over the place, both vertically and horizontally, what with the shore of Loch Leven being a few yards away, the north slope of Benarty and the west slope of Bishophill at equal distances on either side, and the Ochill Hills, rising to 2,000 ft. beyond the loch. In such terrain, low cloud distribution depends on the landscape, medium cloud is apt to become lenticular and sit in the tops of stationary waves, and high cloud is as likely to have spread haphazardly from thunderstorms as in a large-scale pattern from depressions. But, in compensation, there is often a convenient windward slope within reach if all else fails.

The first day was pretty good, unlike the clamped state of England, and a 74-mile out-and-return race was set with the turning-point at Lake of Menteith (the only one in Scotland which is not called a loch), 37 miles due west.

Stephenson got round in 2 hr. 22 min.; he climbed several times to heights of 7,000 to 10,000 ft. Tonkyn took 3 hr. 16 min., finding a light wind against him in both directions; Wills and Thorburn had to land on the return journey.

After a no-contest day, flights to the south-east were made on July 29, when Wills climbed to 8,000 ft. and then glided to Winfield, inland from Berwick-on-Tweed, 54 miles; and Stephenson got as far as Kelso.

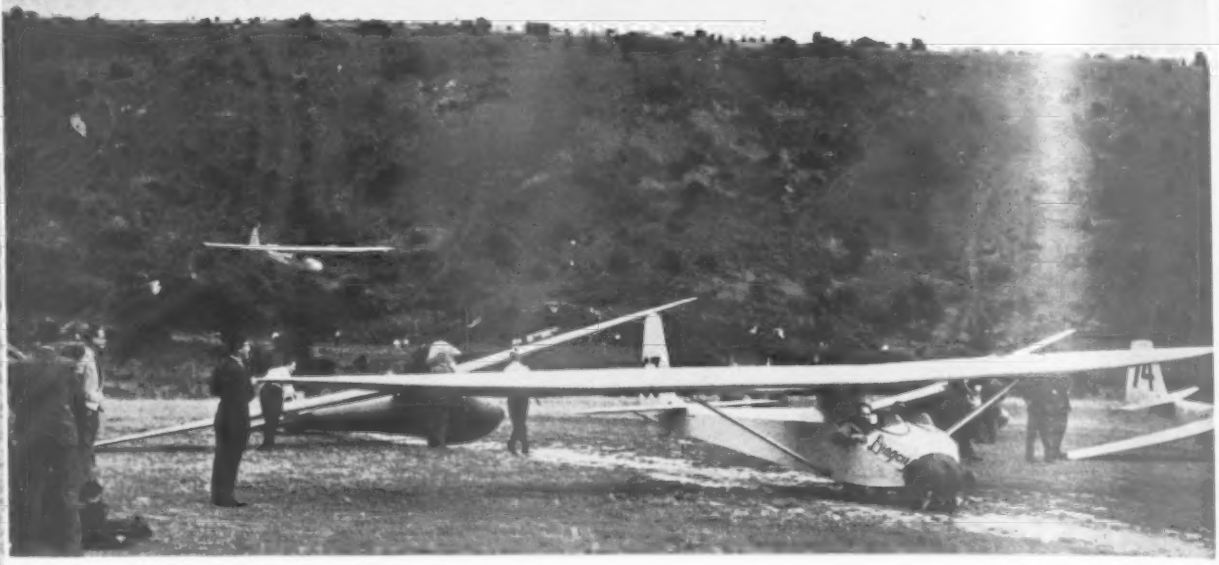
Then again a no-contest day, followed by a "pilot-selected goal" on July 31. Wills, trying for Sutton Bank, and Tonkyn for Newcastle, both reached Winfield, Wills having to follow a sea-breeze front round the coast, while Tonkyn zig-zagged in search of lift. The rest soared over Bishophill till the wind let them down before they could get away, except for Stephenson, the tail of whose sailplane was damaged by a sightseer and was generously repaired over-night by a club member, R. A. B. Williamson, in his Kirkintilloch workshop.

Distance along a line through Fraserburgh, 110 miles away, north of Aberdeen, was set for August 1, but no one managed it. Charles Ross made a valiant attempt to use the lift along a thunderstorm front which appeared to lead in that direction, but was soon down again.

An out-and-return E.N.E. to St. Andrews-and-back, 48 miles altogether, was set next day. Everyone started by soaring over Benarty's north slope, waiting for a "trough" to pass over. When eventually they did set off, most pilots used the north slopes of the Lomond Hills, round the corner from Bishophill, to help them on their way.

Davey finished the course first, in 2¼ hr., but Stephenson beat him to it in 2¼ hr., having started with a 7,000-ft. climb. Thorburn also got round, but on coming out of a big cloud at the turning-point he could not identify the ground sign through the haze, nor could the official observer see him, so he earned no points. Lawson got there, and Wills came five miles of the way back.

The final Sunday brought the week's best soaring weather for another distance task along a line through Fraserburgh, which Wills reached easily with climbs of up to 8,000 ft. in big cumulus. Tonkyn landed eight miles short of the 110, and Stephenson and Thorburn each managed to go 86 miles.



Gliding Notes

by Dr. A. E. Slater

NATIONAL GLIDING WEEK rather overshadowed the gliding activities which went on elsewhere, before and during it. Yorkshire Gliding Club, which did not take part, held a "members' week" at the same time, with 30 people living at Sutton Bank. Chris Riddell, who was to have taken his Skylark 1 to Portmoak, flew it from Sutton Bank instead and made a climb to 10,000 ft.

From Lasham, on Thursday of the previous week, a young German visitor made a triangular flight for Silver "C" distance in a 15-20-knot wind, taking 3 hr. 6 min.; and John Messervy, a resident instructor, tried for a dog-leg 300 km. by taking the Olympia 419 upwind to Westbury and then turning downwind for Lympne, which he missed by 40 miles, probably through not starting till noon. A week later, Andy Coulson, Newcastle Club's chief instructor, who was staying at Lasham, tried a dog-leg 300-km. from there to Great Yarmouth and came down 13 miles short after 7 hours' flying; this was the day the Nympsfield competitors were given a line through Yarmouth and two got there.

Two days later, on Saturday, August 2, Michael Randle made a goal flight of 192 miles to Great Yarmouth from the Long Mynd, becoming the first Midland Club pilot to earn a diamond with a club sailplane, a Skylark 2. A private Skylark 2 was flown 192 miles to Lowestoft in 6 hr. by Ronald Rutherford on the same day, and Dr. Angus McDonald took an Olympia 110 miles to Market Harborough.

Before competing in National Gliding Week with the Bristol Gliding Club at Nympsfield, Peter Scott was busy as usual piling up the hours and laying off the miles with his T-42 Sea Eagle. A solo attempt to reach Great Yarmouth, in the hope of adding a Goal Diamond to his Gold "C," ended at Southwold after 178 miles.

Then came an attempt on the two-seater out-and-return record on July 25, with C. M. Garside, also of the Wildfowl Trust, as a passenger. In a light southerly wind they made 71 miles north-eastwards to Northampton but came down at Broadway on the return journey, 28 miles short. So many newspapers described this as a "forced landing" that Peter Scott was thereafter bothered by numerous friends and acquaintances who wanted to know if he was badly hurt.

* * *

A LAUNCH in tow of a helicopter, made by the Royal Naval Gliding Club at Lee-on-Solent on August 6, was described by some papers as "the first experiment of its kind." So it was in this country, but it had already been done in Poland.

The pilot on this latest occasion was Lieut. Cdr. H. Dimock, R.N.V.R. (retd.). This was not his first unusual experiment in launching gliders. One Sunday last year he had at the club a 17-year-old boy who had never driven a car before, taught him to drive a Ford Anglia, and, before the day was out, had him repeatedly auto-towing a Tutor to 1,000 ft.

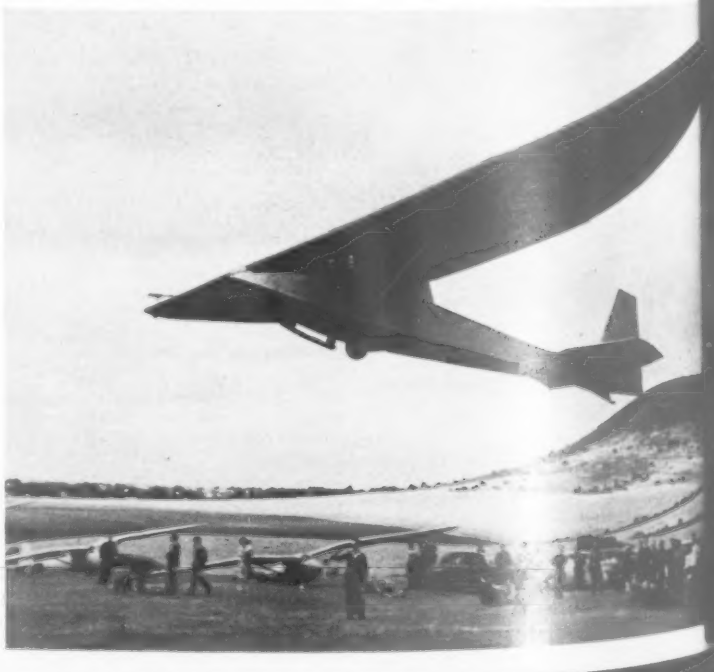
One idea of using a helicopter is to get a glider out of a small field. In Poland the helicopter first hovered overhead to drop a cable, then moved forward slowly to tighten up, and then put on speed and pulled the glider horizontally till it acquired flying speed, after which it was hauled up at a fairly steep angle. The glider, therefore, needs enough room to get up flying speed, as with an aeroplane-tow, but the aeroplane needs a much longer run, which is saved by using a helicopter. But what about the expense?

Another piece of helicopter news comes from Rome, about one which crashed on top of the volcano of Mount Etna. "Investigations by technical experts," it is stated, "indicated that the hot, rarefied air above the crater created an air pocket." Curiously enough, when sailplanes encounter "hot, rarefied air," they go up, not down, even above volcanoes. Robert Kronfeld once soared over Vesuvius. And, once again, what is an air pocket?

* * *

NEW specifications have been issued by the OSTIV for Standard Class sailplanes intended to take part in World Championships. They are in draft form and await approval by the F.A.I. They are largely the same as before; the maximum span is 15 metres. Methods of changing the wing profile are prohibited, and so are retractable undercarriages. Air brakes must still limit the dive to a safe speed, and parachutes may not be used instead.

The major change appears to be compulsory fitting of a landing wheel with a diameter of at least 250 mm. (nearly 10 in.) and a width of at least 70 mm. (2¾ in.). Previously a wheel of any size could be used, or a skid could be fitted instead. Wheel brakes are also recommended, but are not compulsory, so is a cockpit which will hold a 6-ft. 3-in. man comfortably.



SOARING SITE.—These pictures were taken at Dunstable Downs on the final day (August 4) of the National Gliding Week. Names of prizewinners were published in our issue of August 15.

Photographs copyright "The Aeroplane"

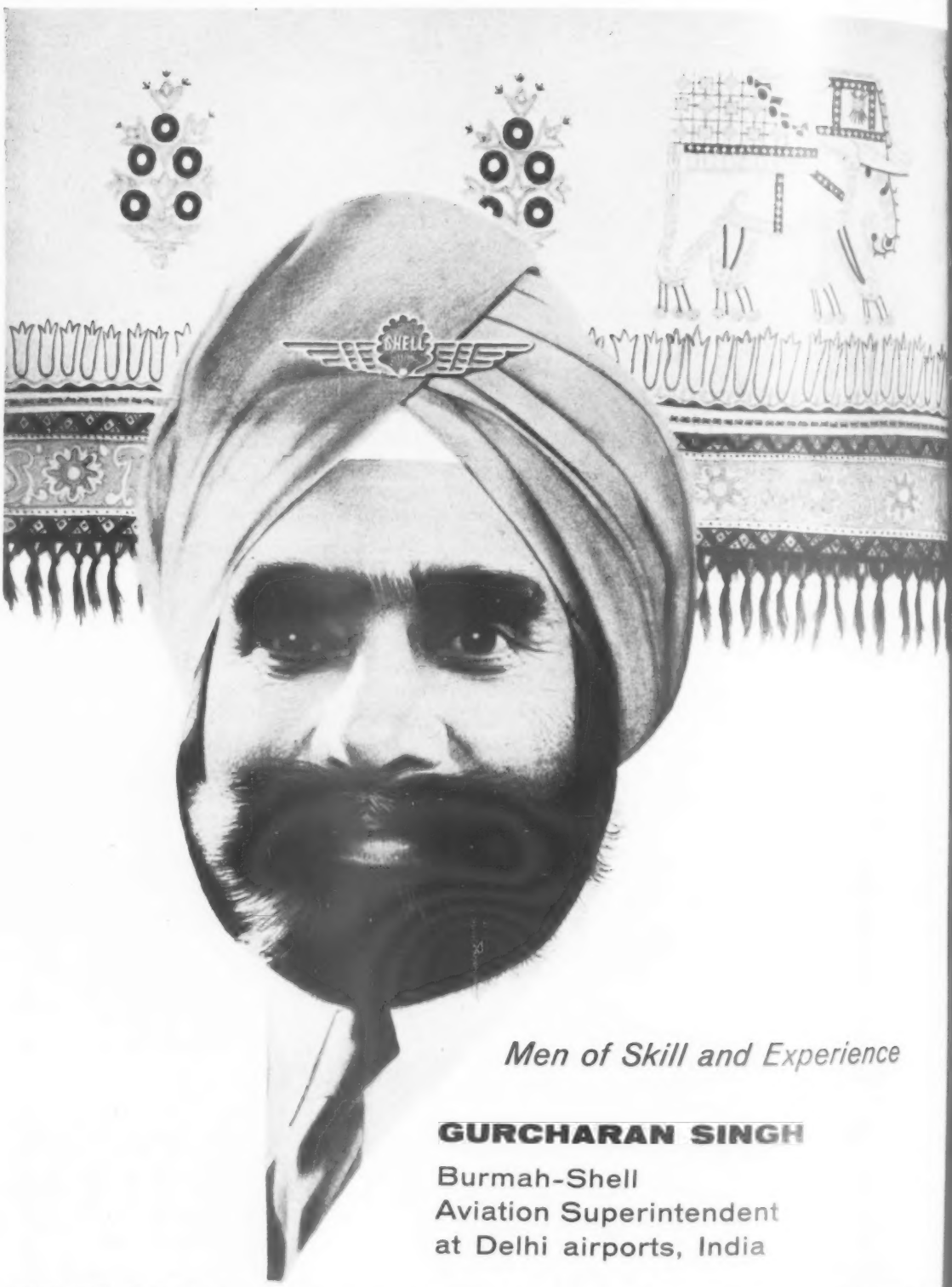
SOLARTRON

RADAR SIMULATORS NOW IN NATO SERVICE

Now being supplied in quantity to NATO member countries, Solartron Radar Simulators are making a most impressive contribution to defence training and are enabling considerable economies to be achieved in the training of radar operators.
Based on a modular construction technique which makes obsolescence impossible, the Solartron Radar Simulator can provide working knowledge of air combat, formation and guided weapon radar displays—with independent, fully manoeuvrable target facilities for any number of targets. A vital exploratory equipment, too, for air traffic control research, a Solartron Simulator can be programmed to pinpoint and analyse civil air traffic problems at any locality—and at any projected date in the future.

Two units of a typical multi-target radar simulator photographed in operation in one of the NATO countries now being supplied with this invaluable training aid.

THE SOLARTRON ELECTRONIC GROUP LTD.
THAMES DITTON · SURREY · TELEPHONE: EMBERBROOK 5522



Men of Skill and Experience

GURCHARAN SINGH

Burmah-Shell
Aviation Superintendent
at Delhi airports, India

ONE OF THE MEN RESPONSIBLE FOR SHELL WORLD-WIDE AVIATION SERVICE

SHELL

Correspondence

Reclassifying the Sailplanes

PETER BROOKS, in his article on "Sailplanes at Leszno, 1958" (THE AEROPLANE, August 8, pp. 207-210), has deluded himself, and presumably some of your readers, by failing to understand the marking system used at Leszno this year.

He has produced a consolidated list (Table I) of the Open and Standard class results by the simple expedient of putting the marks in order, not realizing that each class was separately marked out of 1,000 points each day and that therefore the marks of the two classes are in no way comparable.

By putting the Standard class performances into the Open class results the following is the consolidated classification (first 20 places):—

1	HKS-3	11	Spartak
2	Skylark 3	12	Zugvogel 4 (Standard)
3	Démant	13	Ka 6 BR (Standard)
4	Meteor 57	14	PIK-3C
5	Jaskolka Z	15	Meteor 57
6	Breguet 901S	16	Ka-6 (Standard)
7	Olympia 419	17	Mucha-Standard (Standard)
8	Zugvogel 3	18	Olympia 415 (Standard)
9	Mucha-Standard (Standard)	19	Démant
10	Zugvogel 3	20	Skylark 3

It must be realized that even this comparison is not entirely fair since the standard class were always launched after the open class, i.e., some 20 minutes later. This made no difference on race days but could affect days when distance flying was the task.

Table II of Peter Brooks' article is changed considerably for 1958 by this reclassification and becomes:—

1	Zugvogel 3	24 points
2	Meteor 57	23 points
3	HKS-3	20 points
	Skylark 3	20 points
	Démant	20 points

I leave it to those interested to modify the conclusions reached in the light of the above corrections.

London, W.1. H. C. N. GODDHART. (Commander, R.N.).

The Dangers of Research

PROFESSOR Richards' learned letter (THE AEROPLANE, August 8) does, I suggest, show that scientists working without historians are in danger of making nonsense out of history. He seems to be intent on establishing the irreducible minimum at which it could be said that an aeroplane is sustaining itself free of the effects of momentum (including running down hill), etc., etc. Historians are more concerned with establishing manifest achievement, and are also perhaps more aware of the imponderables which would disqualify any claims to such marginal achievements he discusses. Momentary sustentation by a clearly non-viable machine is certainly no fair historical criterion for a powered flight: one must clearly demand a demonstrable achievement of equilibrium in flight, and I don't think Professor Richards would deny that many a non-viable machine could be kept flying for his minimal times and distances by purely fortuitous circumstances.

The classic case is Clément Ader's test of his *Eole* in 1890, when he claimed—we may say fairly—that he covered "*une distance d'environ cinquante mètres*," which, however, he described only as "*cette tentative*." Charles Dollfus has pointed out that this test can only be classed as a powered take-off, and not as a sustained flight, as the machine was virtually uncontrollable. Surely Professor Richards is not going to claim that as a flight. Incidentally, the Wrights' 12 seconds would probably not have been honoured had they not done 59 seconds the same morning.

Professor Richards' little "plug" for A. V. Roe admirably illustrates the dangers of the scientist "going it alone." I doubt whether he is fully aware of all the circumstances attending the Roe claims, including certain contemporary material which has recently come to light and is now being assessed, and which may again underline the perils of placing too much reliance on distantly retrospective eye-witness reports.

London, W.1. CHARLES H. GIBBS-SMITH.

Monitored Gyroscopes

ON page 142 of THE AEROPLANE dated July 25 last you refer to the S. G. Brown Master Reference Gyro. Your article states that this unit consists of two suitably monitored gyroscopes mounted on and controlling a servo-operated platform. This is not strictly correct. The platform is in fact controlled by one vertical gyroscope. Thus the relationship between the platform and the aircraft provides pitch and roll information. On this controlled, or stabilized, platform there is an azimuth gyro, monitored by a Fluxgate element, which provides heading information.

In addition, it might perhaps be of interest to note that all the latest Royal Air Force and Royal Navy fighter aircraft, together with the Ministry of Supply's very high-speed research aircraft, are fitted with our Master Reference Gyro.

Watford. J. CRAMPTON, Sqn. Ldr., S. G. Brown, Ltd.

[A description of this Master Reference Gyro appeared in THE AEROPLANE for December 27 last.—ED.]

A Real Queen's Cup Race

I MOST heartily endorse Mr. Geoffrey Dorman's letter in THE AEROPLANE for July 25 last. If a real Queen's Cup race could be inaugurated, perhaps His Royal Highness Prince Philip would really put British aviation "on the map" by entering?

There would of course be the usual outcry that a "round the island" race would interfere with normal air traffic—what nonsense! And even if it did, why the heck shouldn't it; is there any good reason why, for about four hours on one day of the year, the lower limits of all airways should not be raised to, say, 5,000 ft.? This would clear the civil traffic, and the Services would be on week-end leave anyway, so what is there for officialdom and its first cousin, bumbledom, to put in the way of the ordinary private citizen's pleasure?

This would be making aviation a worthwhile enterprise in many people's lives.

Luton Airport. S. J. BARTLAM.

You Can't Have it Both Ways:—

The "complex question" of rearward-facing aircraft seating is now being reviewed by a group under the chairmanship of the M.T.C.A.'s chief aeronautical adviser.

NOTES AND EVENTS

QUICK WORK.—Passenger seats by Short Brothers and Harland, Ltd., are designed for easy folding and stowage enabling an aircraft to be quickly converted from passenger to freight transport. The upper picture shows a B.E.A. Viscount with the conversion complete and the seats stowed against the fuselage wall; left, the conversion in progress.

SIGNALLING LAMP.—A new lightweight high-intensity traffic-control signalling lamp being marketed by the General Electric Co., Ltd., has a maximum intensity of 130,000 candelas. It has been tested successfully over a distance of four miles transmitting signals into bright sunlight. The new lamp weighs 4½ lb., has an overall diameter of 7 in. and a barrel length of 7¼ in.

FERRANTI DEVELOPMENT.—Now in quantity production for the R.A.F. and Fleet Air Arm by Ferranti, Ltd., is a 3½-in. standby artificial horizon. It has also been specified for the Comet and Vanguard by B.O.A.C. and B.E.A. A standby directional gyro is being developed which will operate in conjunction with the standby artificial horizon providing a self-contained standby gyro system. This system has four main components: artificial horizon, direction indicator, azimuth gyro and control inverter, and can be operated from an AC or DC power supply in aircraft equipped with remote indicating instrument systems.

AGARD MEETINGS.—An AGARD meeting on "Engine Test Facilities and Techniques" will take place on October 23 and 24 in Copenhagen. The Eighth General Assembly opens there on October 28. There will be a discussion on "The Impact of Space Technology on NATO Research and Development."

COMPUTER EXHIBITION.—The Electronic Computer Exhibition, the first of its kind in Europe, is to be held at Olympia, London, from November 28 to December 4. With the exhibition there is to be a Business Computer Symposium. Both have been organized by the Electronic Engineering Association and the Office Appliance and Business Equipment Trades Association at the instigation of the National Research Development Corpn. The exhibition will show British contributions made by manufacturers to development and use of electronic computers and data-processing equipment.

Aviation Calendar

August 30.—Opening of new airport restaurant at Sywell **Aerodrome**, Northampton, by Gp. Capt. D. R. S. Bader, C.B.E., D.S.O., D.F.C., at 12.00 hrs.

August 30.—R.A.F.A., Colwyn Bay branch, Air Display at Eirias Park, **Colwyn Bay.**

August 31.—Oxford Aeroplane Club "At Home," at **Kidlington Airport**, Oxford.

September 3.—S.L.A.E. main lecture: "The Engineering Development of Turbine Aircraft as Influenced by World Traffic Patterns," by D. J. Lamberth, A.M.I.Mech.E., A.F.R.Ae.S., assistant general manager (development), Vickers-Armstrongs (Aircraft), Ltd., in the main assembly hall, R.A.E., **Farnborough**, Hants, at 18.30 hrs.

September 3-7.—S.B.A.C. Display and Exhibition at **Farnborough.**

September 4.—Helic. Assn. of G.B. annual dinner at the Dorchester Hotel, Park Lane, **London**, W.1.

September 4-6.—AGARD Avionics Panel Meeting at **Cambridge University.**

September 8-13.—First International Congress of the Aeronautical Sciences, **Madrid.**

September 12-22.—Aeronautical Pentathlon and Air Rally at **Liège**, Belgium.

September 15-21.—Battle of Britain Week.

September 20.—Aviation Forum of London annual dinner, at the Aerodrome Hotel, **Croydon**, Surrey.

September 21.—Sailplane aerobatic competition organized by the London Gliding Club, at **Dunstable**, Beds.

September 21.—Air Rally organized by the Milan Aero Club, at **Milan.**

September 21.—Royal Belgian Aero Club international concourse for balloons, **Brussels.**

September 25.—R.Ae.S. Graduates and Students' Section lecture: "The New Generation of Civil Aircraft," by G. H. Lee (Handley Page, Ltd.), in the Library, 4 Hamilton Place, **London**, W.1, at 19.30 hrs.

September 26-29.—Austrian Aero Club Rally at **Innsbruck.**

September 27-28.—"Tipsy Week-end" organized by the A.S. Flying Club, at Baginton Airport, **Coventry.**

October 4.—Aviation Forum of London lecture: "The Channel Air Bridge," by Douglas Whybrow, at the Imperial Hotel, Elizabeth Street, Victoria, **London**, S.W.1, at 19.00 hrs.

October 9.—Society of Instrument Technology Control Section lecture: "Aircraft Flight Simulators," by Dr. A. E. Cutler, B.Sc., Ph.D., at Mansion House, Portland Place, **London**, W.1, at 17.30 hrs.

October 16.—R.Ae.S. Graduates and Students Section lecture: "The Future of Aircraft," by Mat. P. L. Teed (Vickers-Armstrongs), in the Library, 4 Hamilton Place, **London**, W.1, at 19.30 hrs.

OWEN ACQUISITION.—The business of Mechanair, formerly carried on by Acocks Engineering Co., Ltd., has been acquired by Rubery, Owen and Co., Ltd. The former company manufactures air compressors, pressure vessels, aircraft de-icing equipment, welded fabrications and test rigs, etc. These items will in future be made at Rubery, Owen's factory at Darlaston, Wednesbury, Staffs. The former managing director of Acocks Engineering Co., Mr. J. E. Kavanagh, will be in charge of the Mechanair division of Rubery, Owen and Co., Ltd.

TEMPERATURE RECORDER.—A new multi-point thermocouple temperature recorder, which provides a permanent printed record of the temperature being measured from any one of up to 500 points, the time at which it was taken and the channel identification, is being produced by Savage and Parsons, Ltd., of Watford, Herts. The maximum temperature range with which the equipment can deal is between 800° C. and [illegible]° C., depending on the type of thermocouple used.

Personal Notices

BIRTHS

Adamson.—On August 9, at Rutland Memorial Hospital, Oakham, to Edna (*née* Morpeth), wife of Sqn. Ldr. Henzell Adamson—a son.

Austin.—On August 5, at Camberley, to Jean (*née* Cock), wife of Sqn. Ldr. P. C. Austin—a daughter.

Brennan.—On August 5, at Avonside, Enford, Wilts, to Betty (*née* Silk), wife of Wg. Cdr. T. N. N. Brennan—a daughter.

Hall.—On August 9, at Oakham Hospital, to Marie Rose, wife of Flt. Lt. L. Hall—a son.

Lethbridge.—On August 12, at Cheltenham, to Avril (*née* Burnham), wife of Flt. Lt. A. Lethbridge—a son.

Miller.—On August 13, at R.A.F. Hospital, Halton, to Adele (*née* Colleypriest), wife of Sqn. Ldr. J. J. Miller—a daughter.

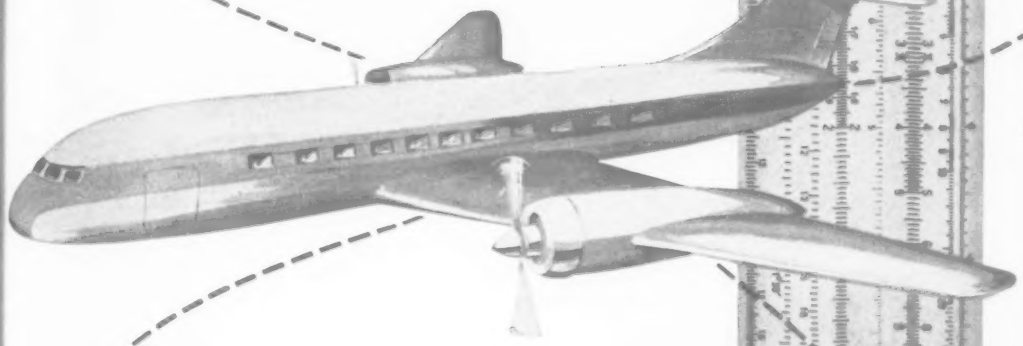
Quinn.—On August 6, at R.A.F. Hospital, Halton, to Marjorie, wife of Sqn. Ldr. G. D. P. Quinn—a daughter.

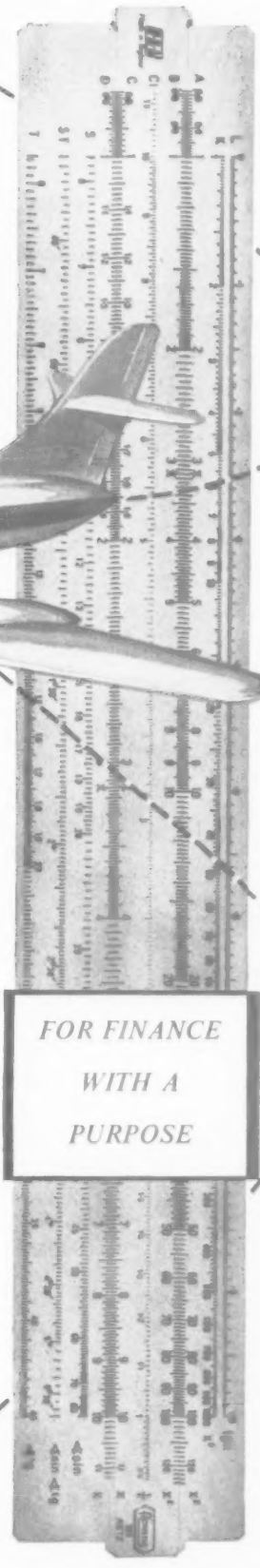
Woodhams.—On July 24, at Leamington Spa, to Jennifer (*née* Greenwood), wife of E. M. Bill Woodhams—a daughter.

MARRIAGE

Gordon Longstaff.—At Beeford, E. Yorks, Sqn. Ldr. C. R. Gordon to Miss G. Longstaff.

THE *ECONOMICS* OF LIFT AND DRAG





Aerodynamically, the designer calculates lift and drag, and a lot of other things . . . the airline operator simply demands lift, in passenger or ton miles. Equipping himself with economic aircraft is essential to the success of his business. That is where Lombank, by providing credit facilities, can help.
Discuss the question of lifting your company into secure profitability by consulting your local Lombank manager —or write to me, in strict confidence.

FOR FINANCE WITH A PURPOSE

LOMBANK

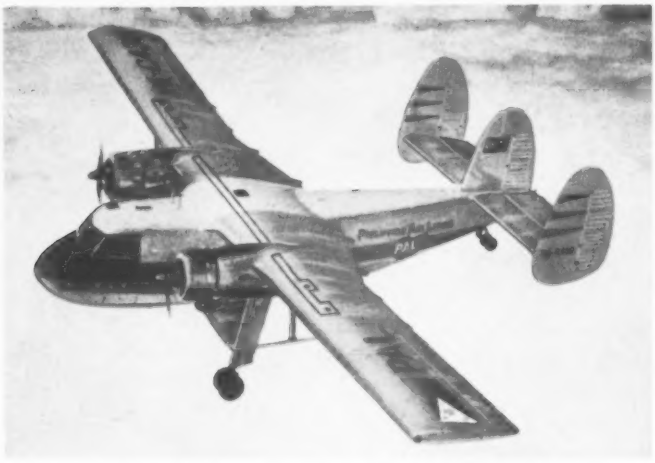
for finance with a purpose.

Head Office: LOMBARD HOUSE,
CURZON STREET, PARK LANE, LONDON, W.1
Telephone: GROsvenor 4111 (30 lines)

A SUBSIDIARY OF LOMBARD BANKING LTD.
BRANCHES THROUGHOUT THE WORLD.

LK6

Now available with Pratt & Whitney Engines



Philippine Air Lines have specified Pratt & Whitney engines for their five Twin Pioneers to be delivered December 1958. The P.A.L. Twin Pioneers specifications include a nineteen passenger interior, American instrumentation and the addition of a 74 cu. ft. aft. cargo compartment.

Air Engine Services Limited, Pratt & Whitney specialists, are proud to have been chosen as the sole supplier for the P & W power plant.

THE INSTALLATION OF 600 h.p. PRATT & WHITNEY ENGINES IN THE SCOTTISH AVIATION TWIN PIONEER OFFER THE FOLLOWING ADVANTAGES:—

ECONOMY: Reduced maintenance and overhaul costs.

RELIABILITY: Over 35,000 P & W R-1340 engines have been manufactured. This proven engine provided the power for the D.H. Otter on its historic Polar flight.

PRICE: The proven reliability of the P & W power plant is available in the Twin Pioneer at no increase in price.

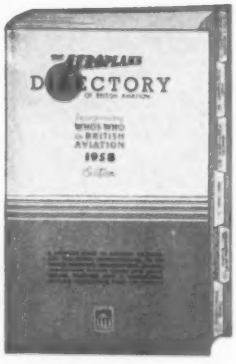
SERVICE: P & W spares and service facilities are available throughout the world.

AIR ENGINE SERVICES LIMITED
BLINDLEY HEATH, LINGFIELD, SURREY

For additional information apply to the sole sales agents:—

ANSOR CORPORATION
7 BIRCHIN LANE, LONDON, E.C.3

THE AEROPLANE



INCORPORATING 'WHO'S WHO IN BRITISH AVIATION'

Dy. 8vo. (Linson Boards)

DIRECTORY OF BRITISH AVIATION, 1958

This 1958 edition of *The Aeroplane Directory of British Aviation*, compiled by the Staff of THE AEROPLANE, provides the latest information covering all facets of aeronautical activity in the United Kingdom and in the countries of the British Commonwealth.

The Service Aviation section lists all major appointments in the Royal Air Force and the Air Ministry, senior posts in the Commonwealth Air Services and NATO Air Forces. It includes the names of British and Foreign Air Attachés, V.C.s of the Air and active Service Air Stations in the United Kingdom.

The Commercial Aviation section gives details of all Aircraft Operating Companies in Great Britain and the Commonwealth, and contains a 230-page classified directory of the British and Commonwealth Aviation Industries.

Principal appointment holders in the Ministries of Supply, Transport and Civil Aviation, the Air Registration Board and other British aeronautical authorities are named and details are given of Professional Societies, Learned Bodies and International Societies concerned with aviation. Some 247 Flying and Gliding Clubs in the United Kingdom and Commonwealth are listed and there is a special section devoted to Aeronautical Training facilities. There is also a Biographical Section containing over 1,500 entries.

30s. net from Booksellers or by post 31s. 9d. from the Publishers

TEMPLE PRESS LIMITED · BOWLING GREEN LANE · LONDON EC1

SOMETHING IN THE AIR

Scheduled passenger, cargo and mail services. Contract operations, helicopter operations, aircraft maintenance and modification. Overseas based operations. Aerial crop spraying. The Airwork School of Aviation. Aircraft sales and purchase. Spare parts sales and purchase. Radio installation and maintenance. Aircraft catering, flying club operation, and aircraft insurance.

AIRWORK LIMITED

AIRWORK HOUSE, 35 PICCADILLY, LONDON, W.1 TELEPHONE REGENT 8494

G&G